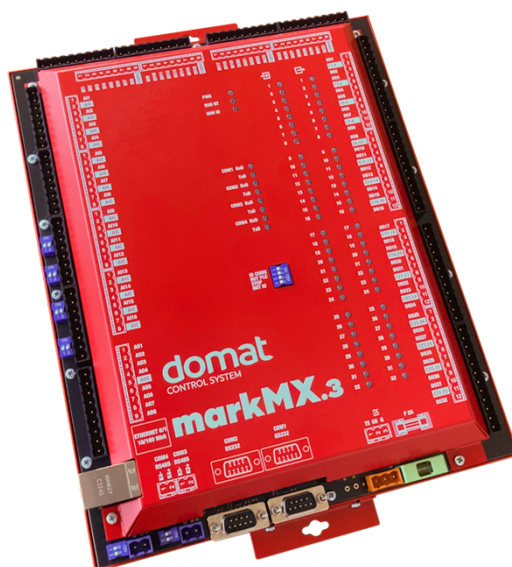# markMX.3   DDC controller

Summary

DDC (Direct digital control) controller markMX.3 is a free programmable process station with i.MX6 processor and Linux operating system. It is suitable for control of large installations. MarkMX.3 contains two Ethernet ports, 2× RS485 interface, and 2× RS232 interface for expanding I/O modules. On the board there is an I/O mix of 16 AI, 32 DI, 8 AO, and 32 DO.

Application

- **Free programmable control units for HVAC systems and other applications with local HMI and web access**
- **Data acquisition, processing, and presentation systems with advanced networking features**
- **Controls of power systems, photovoltaic power plants etc.**
- **Protocol converters with web data presentation (must be programmed by user)**

Function

The controller hosts an embedded Linux operating system which boots up the Domat runtime with the application. The board contains real time clock with battery backup, flash memory containing OS, runtime, application, and other data (time programs, setpoints etc.), and a watchdog. It is also possible to use NVRAM to backup parameters in case of unexpected system shutdown.

The application is created and uploaded in the Domat IDE development environment. The maximum application program size depends on number of physical and software data points, amount of function blocks which require more memory (e.g. time schedulers), degree of code optimisation, and number of connections the PLC has to handle.

For communication with other devices, markMX.3 contains 2× Ethernet port, 2× a RS485 interface and 2× a RS232 interface. The I/O part (16 AI, 8 AO, 32 DI, 32 DO) communicates with the PLC over a RS485 data bus. This internal module communicates as a MXIO **at COM port 3, address 2**. There may be more modules using Modbus RTU at the same channel, connected over the COM3 port.

The process station contains a web server for remote connection and user intervention. The web pages are created in Domat IDE HMI editor, which is included in the package of development programs. The exported web definition is uploaded to the process station through Domat IDE. From the security point of view, the website is not recommended for use in the public network, it is intended for operation in a local network., Therefore it is necessary to integrate the configured router or other element that ensures network security during the design of the network topology.
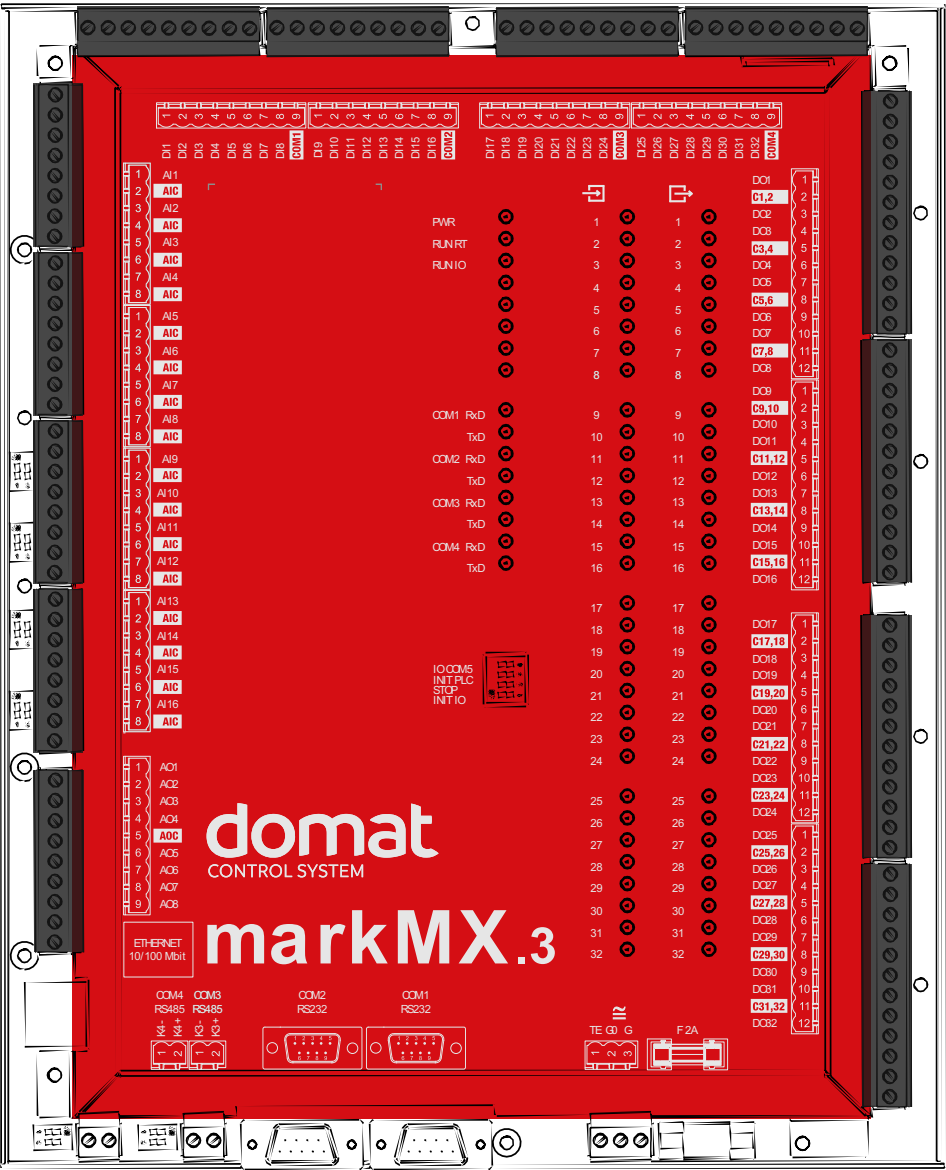
The PLC can be mounted on the base plate of the switchboard, or on another flat and smooth surface by two screws.

Technical data

Supply voltage	24 V AC/DC ± 10 %; 20 W
Communication	
Ethernet	2 × Ethernet 10/100 BaseT,
	RJ45, 2 LED (link, data) integrated in the connector
RS232	COM1, COM2
	2 × CANNON 9 male; pin 2=RX, 3=TX, 4=DSR, 5=GND, 6=DTR, 7=RTS, 8=CTS
	300...115 200 bit/s, parity and bits are set in software
RS485	COM3, COM4 RS485 (K+, K-)
	2 separated buses galvanically insulated from each other, insulating voltage 1 kV
	300...115 200 bit/s
	bus end
	parity and bits are set in SW
	maximal bus length 1200 m
	maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications use about 300...400 physical data points on the bus
LED	3 × system: PWR, RUN RT, RUN IO
	2 × LINK/DATA (ETHERNET)
	8 × communication: COM1...4 RxD, TxD
	32 × digital inputs: DI1...32
	32 × digital outputs: DO1...32
Analogue inputs	
Number	8 × resistance measuring only
	8 × resistance/voltage/current measuring selectable
Resistance measuring range	0...1600 Ω, 0...5000 Ω; sensor Pt1000

	Characteristics Pt100, Pt500, Pt1000, Ni1000 - 5000, Ni1000 - 6180 can be transformed from resistance input by predefined transformation in the process station application.
Voltage measuring range	0...10 V DC (input settings is possible over Domat IDE)
Current measuring range	0(4)...20 mA (for hardware input settings see section Terminals -> DIP switches; the range also must be set in Domat IDE)
Resolution	16 bits
Measuring error (from range)	0.25 %
Measuring frequency	1/s
Input impedance	> 10 MΩ
Galvanic insulation	insulating voltage 1 kV
Analogue outputs	
Number	8
Voltage range	0...10 V DC
Analogue outputs load	min. 10 kΩ, current 10 mA each output;
	outputs are short-circuit protected by current limitation to 20 mA
Resolution	10 bits
Galvanic insulation	insulating voltage 1 kV
Digital inputs	
Number	32
Voltage measuring range	24 V AC/DC – voltage must be applied (no dry contacts)
Max. switching frequency	10 Hz
Digital outputs	
Number	32
Load	relay, normally open: 5 A/250 V AC, 5 A/30 V DC, 750 VA, 90 W
	(AC1, non-inductive load EN 60947-4-1)
HW	CPU ARM i.MX6UL 528 MHz, 64 MB FLASH, 128 MB SRAM, 128 kB NVRAM FRAM, realtime clock 20 ppm, watchdog
SW	Domat IDE 2.5.0.5 or later
Housing	Steel, powder coated surface
Dimensions	292.3 (h) × 237 (w) × 40 (d) mm (module)
	324.3 (h) × 237 (w) × 40 (d) mm (incl. fixtures)
Protection degree	IP20 (EN 60529)
Terminals	screw terminals M3, cross-section 0.35...1.5 mm^2

Ambient conditions	from -20…50 °C; 5…85% relative humidity; non-condensing gases, chemically non-aggressive conditions, fog, ice and frost (according EN IEC 60721-3-3 ed. 2:2019 climatic class 3K22, 1K21, 3M11)
	for installation at high altitude, it is necessary to consider the reduction of dielectric strength and a limited cooling air (EN IEC 60664-1 ed.3: 2020)
Standards of conformity	EMC EN IEC 61000-6-2 ed. 4:2019, EN IEC 61000-6-4 ed. 3:2019 (industrial environment)
	electrical safety EN IEC 62368-1 ed. 2:2020+A11:2020
	hazardous substances reduction EN IEC 63000:2019

Terminals

Terminals and connectors:

F 2 A	Fuse F2A. Replace only with the same type if fuse broken.
G	power
G0	power
TE	optional connection for shielding
COM1 RS232	port COM1 - serial link RS232; CANNON 9 male
COM2 RS232	port COM2 - serial link RS232; CANNON 9 male
COM3 RS485	port COM3 - serial link RS485, terminals K+, K-
COM4 RS485	port COM4 - serial link RS485, terminals K+, K-

Notice:

Remember that **the internal I/O module is connected to COM3 on address 2**, and the COM3 port must be configured as Modbus RTU to reach the module.

Ethernet	network interface

Analogue inputs

AI1…8 **analogue inputs 1… 8**
are designed as **passive only**. The range (0...1600 Ω (default), 0...5000 Ω, Pt1000) can be set over Domat IDE.

AI9…16 **analogue inputs 9…16**
can be set so as to measure (when changing, it is necessary to write the settings to the RXIO module, solution tree on the left select the PLC -> channel -> RXIO right-click and choose Domat module configuration)

- **resistance** (same as AI1 to AI8),
- **voltage** 0...10 V (default) or
- **current** 0...20 mA.

The AI9 to AI16 0...20 mA ranges are set using a DIP switch **for each input independently**. The jumpers are accessible from outside of the module.

Range	DIP switch
resistance, passive temperature sensors	OFF (default)
voltage 0...10 V	OFF (default)
current 0...20 mA	ON

AIC **analogue inputs ground** (common for all AI)
Notice:

All analogue inputs AI1 to AI16 have common ground AIC. The inputs are optically separated from the other parts of the I/O module. For three-wire connection (active sensors, e.g. pressure, humidity), the analogue input ground AIC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the markMX.3 module.

Analogue outputs

AO1…8   **analogue outputs 1…8**
Notice:
The outputs are short-circuit protected and optically separated from the other circuits in the module, and their ground (AOC) is not connected to the analogue inputs ground.

AOC   **analogue outputs ground**
Notice:
The ground is optically separated from the other parts of the I/O module. For three-wire connection (active periphery, e.g. valves actuators, frequency changer), the analogue input ground AOC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the markMX.3 module.

Digital inputs

DI1…32   **digital inputs 1…32**
Notice:
Digital inputs operate with 24 V AC/DC. Each set of eight digital inputs have their own common COM terminals. The inputs are optically separated from the other circuits in the module, and they may be linked to the same transformer or power supply which supplies the markMX.3 module.

COM1   **digital inputs ground DI1…8**
Notice:
The ground is optically separated from the other parts of the I/O module.

COM2   **digital inputs ground DI9…16**
Notice:
The ground is optically separated from the other parts of the I/O module.

COM3   **digital inputs ground DI17…24**
Notice:
The ground is optically separated from the other parts of the I/O module.

COM4   **digital inputs ground DI25…32**
Notice:
The ground is optically separated from the other parts of the I/O module.

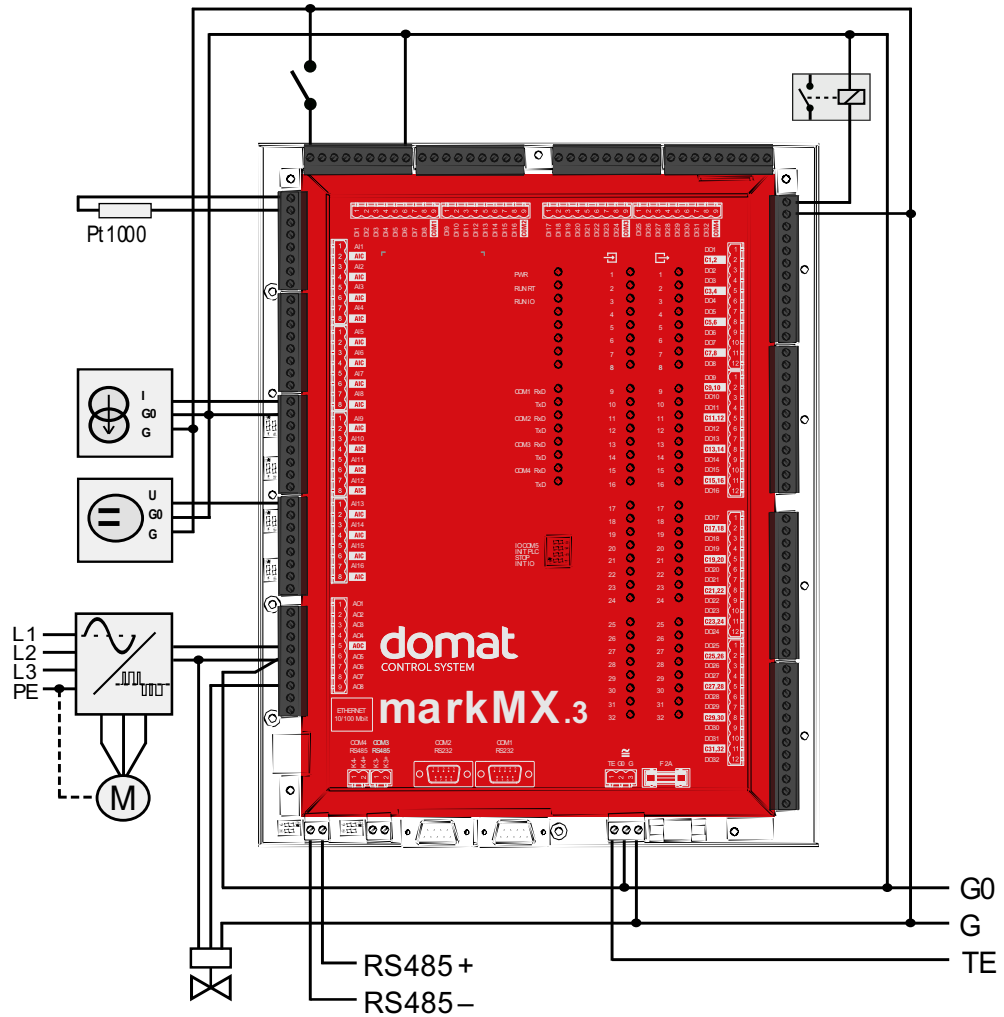**Digital outputs**

DO1…32   **digital outputs 1…32**
Notice:
Digital outputs are normally open relays with maximum voltage 250 V, 5 A. Each pair of outputs has one common terminal (CX, Y).
The statuses of the outputs are indicated by LEDs at the front panel of the module.

CX,Y	Common conductor for two neighbouring digital outputs with number X and Y.

LED indication

PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, …)
RUN RT	yellow LED – system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in other pattern, LED is permanently ON or OFF)
RUN IO	red LED - flashes: I/O module OK; OFF: error in the I/O module
RxD	green LED – receiving data at the respective COM (flashing: receiving data; OFF: no data traffic)
TxD	red LED – transmitting data at the respective COM (flashing: transmitting data; OFF: no data traffic)
LED DI1…32	Indication the statuses of the inputs (ON: voltage 24 AC/DC ±10 %; OFF: no or low voltage)
LED DO1…32	Indication the statuses of the outputs (ON: relay closed; OFF: relay open)

DIP switches

IO COM5	after switching DIP1 to the ON position, the internal I/O module communicates on the COM5 port at a speed of 9600 bit/s (you can set the speed up to 460800 bit/s). It is also necessary to change the settings of the given channel in the IDE and upload the project.
INIT PLC	if ON at power-up, configuration parameters are brought to defaults (see Configuration parameters in Domat IDE; for example IP address, user and password, database and proxy settings, etc.)
STOP	if ON runtime is running, program execution is stopped
INIT IO	if ON at power-up, communication parameters of the I/O module is set to 9600 bps, N, 8, 1
BUS END	DIP1 and DIP2 both set to ON = the respective RS485 bus is terminated, in the OFF position the terminating resistors are disconnected. The first and the last module on the bus should have the BUS END on. The DIP switch is accessible through a small aperture close to the K+, K- terminals.

Connection

Others

Ethernet

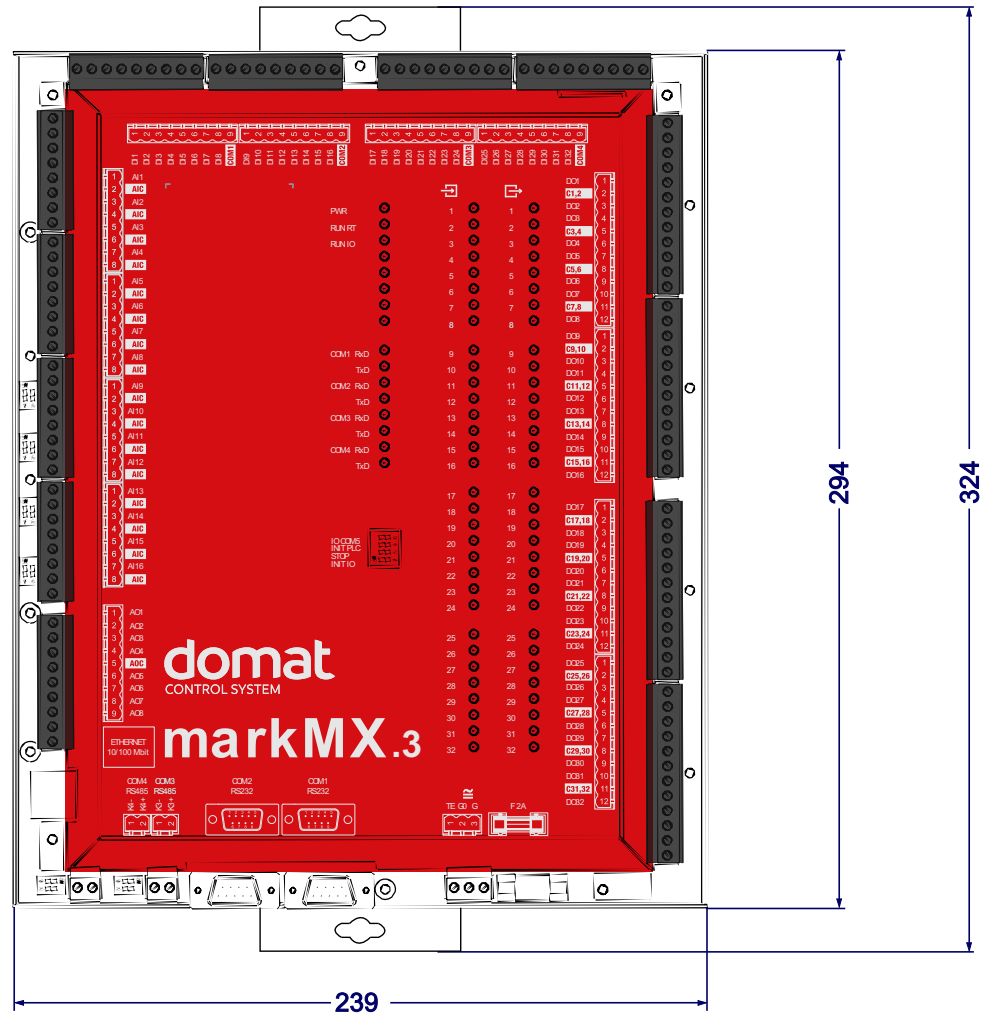The 10/100 Mbit/s Ethernet RJ45 connector links the markMX.3 to
- engineering notebook with Domat IDE
- web client (if web access is configured)
- RcWare Vision – SCADA
- other process stations for data exchange
- other clients
- the Internet for e-mail alarming.

Other topologies on request, contact Domat Control System technical support please.

Addressing

The Modbus address of the internal I/O module is set to 2, default communication parameters are 9600, 8, N, 1.

Dimensions

Dimensions are in *mm.*

Programming   **Domat IDE**

The main programming tool is the Domat package which contains I/O editor, graphical editor of the function plan (FBD), structure text editor and compiler (Domat IDE). The Domat IDE also contains LCD menu editor as well as web editor.

The application program consists of function blocks which are stored in libraries. Those contain analogue and digital functions, mathematical blocks including goniometric functions, time schedulers, alarm blocks, and HVAC specific blocks (heat recovery, dewpoint calculation, enthalpy, pump switch etc.).

The minimum guaranteed number of records for history on the PLC is 37 000, but the actual number of stored samples may be larger depending on the data types that are stored in the history. The program can be set up also as structure text (ST) or with combination of both types of programming languages.

In case of implementation of your own ST driver, there is limitation of max. 10 clients connected simultaneously.

Communication	Default network settings are:

IP address	192.168.1.10
subnet mask	255.255.255.0
default gateway	192.168.1.1

SSCP user: admin
Password: rw

Notice: Do not forget to record the new network settings after change!

After these values have been changed, it is possible to bring the process station into default settings by the INIT PLC DIP switch: set INIT to ON and restart the station. All values in the PLC configuration are set to defaults. The PLC will respond at the default IP address and it is possible to change the old address through Domat IDE.

The controllers can share variables over the Ethernet network (outside temperature, heat demands etc.) together with other PLC platforms.

The runtime provides drivers for communication with I/O modules and other subsystems. For example Domat runtime contains: Modbus TCP / RTU (server/client), M-Bus, IEC62056-21, SSCP, SoftPLC link and BACnet IP server/client (viz PICS). The complete list of drivers can be found in the Channel configuration dialogue in the most recent Domat release. Please check the required protocol features and functions with the list of implemented features in the Domat IDE help. It is also possible to program own communication drivers using the I/O library functions in structure text language.

Number of communication channels (on the serial lines and Ethernet) to I/O modules and subsystems is not directly restricted. It depends on available RAM PLC memory.

Number of connections from SSCP clients is max. 20. This includes connections from Domat IDE, Domat SCADA, HT104/200, mobile application Domat Visual, connection from other PLCs over SSCP etc.

Uploading a project from the Domat IDE reserves two SSCP TCP connections.

Number of connections from Modbus TCP clients on Modbus TCP server is max. 5.

Other clients channels (web, …) are not directly restricted.

WEEE notice   The device contains a non-rechargeable battery which backups the real-time clock and part of the memory. After the device is not operable, please return it to the manufacturer or dispose of it in compliance with local regulations.

Safety note   The device is designed for monitoring and control of heating, ventilation, and air conditioning systems. It must not be used for protection of persons against health risks or death, as a safety element, or in applications where its failure could lead to physical or property damage or environmental damage. All risks related to device operation must be considered together with design, installation, and operation of the entire control system which the device is part of.

Cyber security note

The product may influence the information and cyber security (ICS) of the control system. It is supplied in default settings. Implementation and continuous compliance with the ICS rules (e.g. creating and upload of certificates and keys, their updates and management, protection against misuse, etc.) are fully the responsibility of the control system operator. The manufacturer is not responsible for damages which originated or may originate due of wrong or insufficient implementation of ICS rules when using the device. In case of questions, please contact Domat Control System technical support.
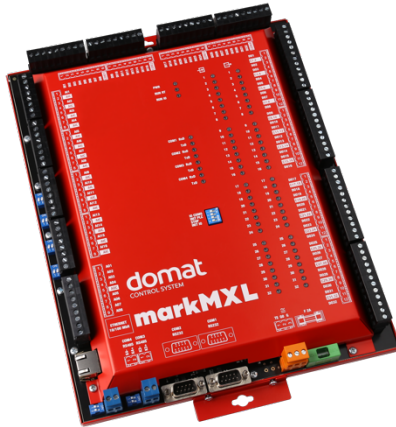
Changes in versions

07/2023 – First datasheet version.
08/2023 – Change of names from Merbon to Domat
04/2024 – Addition of pin descriptions for CAN 9 (RS-232) ports.

markMXL　　　　DDC controller

Summary

DDC (Direct digital control) controller markMXL is a free programmable process station with i.MX6 processor and Linux operating system. It is suitable for control of large installations (approximately 400…500 physical data points). MarkMXL contains two ethernet ports, 2 × RS485 interface, and 2 × RS232 interface for expanding I/O modules. On the board there is an I/O mix of 16 AI, 32 DI, 8 AO, and 32 DO. Compared to markMX.3 process station the markMXL has bigger memory (512 MB RAM, 256 MB FLASH) and support for .NET drivers.

Application

- **Free programmable control units for HVAC systems and other applications with local HMI and web access**
- **Data acquisition, processing, and presentation systems with advanced networking features**
- **Controls of power systems, photovoltaic power plants etc.**
- **Protocol converters with web data presentation (must be programmed by user)**

Function

The controller hosts an embedded Linux operating system which boots up the Domat runtime with the application. The board contains real time clock with battery backup, flash memory containing OS, runtime, application, and other data (time programs, setpoints etc.), and a watchdog. It is also possible to use NVRAM to backup parameters in case of unexpected system shutdown.

The application is created and uploaded in the Domat IDE development environment. The maximum application program size depends on number of physical and software data points, amount of function blocks which require more memory (e.g. time schedulers), degree of code optimisation, and number of connections the PLC has to handle.

For communication with other devices, markMXL contains 2 × Ethernet port, 2 × a RS485 interface and 2 × a RS232 interface. The I/O part (16 AI, 8 AO, 32 DI, 32 DO) communicates with the PLC over a RS485 data bus. This internal module communicates as a MXIO **at**

COM port 3, address 2. There may be more modules using Modbus RTU at the same channel, connected over the COM3 port.

The process station contains a web server for remote connection and user intervention. The web pages are created in Domat HMI editor, which is included in the package of development programs. The exported web definition is uploaded to the process station through Domat IDE. From the security point of view, the website is not recommended for use in the public network, it is intended for operation in a local network., Therefore it is necessary to integrate the configured router or other element that ensures network security during the design of the network topology.

The PLC can be mounted on the base plate of the switchboard, or on another flat and smooth surface by two screws.

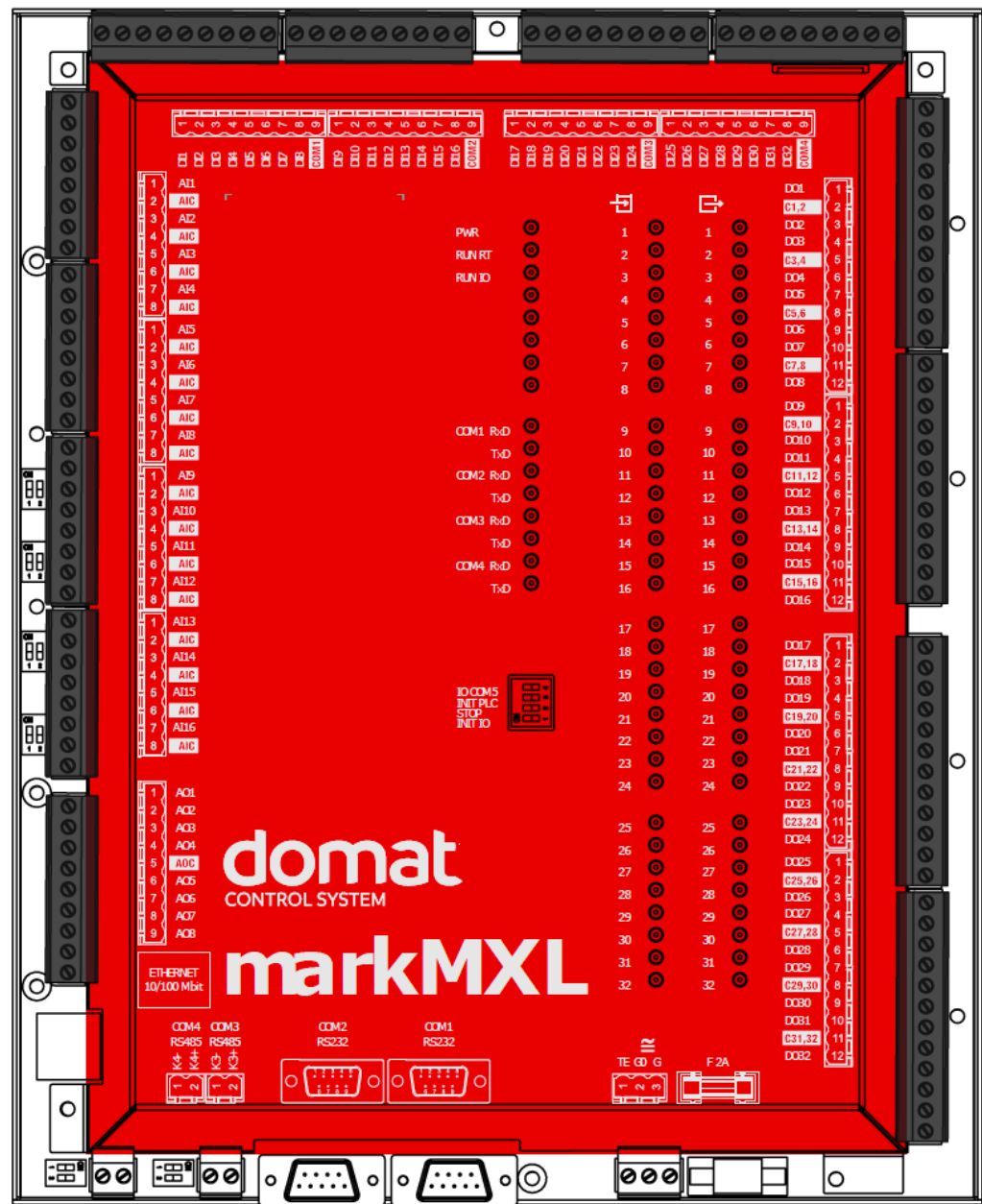|	
Technical data	

Supply voltage	24 V AC/DC ± 10 %; 20 W
Communication	
Ethernet	2 × Ethernet 10/100 BaseT,
	RJ45, 2 LED (link, data) integrated in the connector
RS232	COM1, COM2
	2 × CANNON 9 male; pin 2=RX, 3=TX, 4=DSR, 5=GND, 6=DTR, 7=RTS, 8=CTS
	300...115 200 bit/s, parity and bits are set in software
RS485	COM3, COM4 RS485 (K+, K-)
	2 separated buses galvanically insulated from each other, insulating voltage 1 kV
	300...115 200 bit/s
	bus end
	parity and bits are set in SW
	maximal bus length 1200 m
	maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications use about 300...400 physical data points on the bus
LED	3 × system: PWR, RUN RT, RUN IO
	1 × LINK/DATA (ETHERNET)
	8 × communication: COM1...4 RxD, TxD
	32 × digital inputs: DI1...32
	32 × digital outputs: DO1...32
Analogue inputs	
Number	8 × resistance measuring only
	8 × resistance/voltage/current measuring selectable
Resistance measuring range	0...1600 Ω, 0...5000 Ω; sensor Pt1000
	Characteristics Pt100, Pt500, Pt1000, Ni1000 - 5000, Ni1000 - 6180 can be transformed from resistance input by predefined transformation in the process station application.
Voltage measuring range	0...10 V DC (input settings is possible over Domat IDE)

Current measuring range	0(4)...20 mA (for hardware input settings see section Terminals -> DIP switches; the range also must be set in Domat IDE)
Resolution	16 bits
Measuring error (from range)	0.25 %
Measuring frequency	1/s
Input impedance	> 10 MΩ
Galvanic insulation	insulating voltage 1 kV
Analogue outputs	
Number	8
Voltage range	0...10 V DC
Analogue outputs load	min. 10 kΩ, current 10 mA each output; outputs are short-circuit protected by current limitation to 20 mA
Resolution	10 bits
Galvanic insulation	insulating voltage 1 kV
Digital inputs	
Number	32
Voltage measuring range	24 V AC/DC – voltage must be applied (no dry contacts)
Max. switching frequency	10 Hz
Digital outputs	
Number	32
Load	relay, normally open: 5 A/250 V AC, 5 A/30 V DC, 750 VA, 90 W (AC1, non-inductive load EN 60947-4-1)
HW	CPU ARM i.MX6UL 528 MHz, 256 MB FLASH, 512 MB SRAM, 128 kB NVRAM FRAM, realtime clock 20 ppm, watchdog
SW	Domat IDE
Housing	Steel, powder coated surface
Dimensions	292.3 (h) × 237 (w) × 40 (d) mm (module) 324.3 (h) × 237 (w) × 40 (d) mm (incl. fixtures)
Protection degree	IP20 (EN 60529)
Terminals	Screw terminals M3, cross-section 0.35...1.5 mm^2
Ambient conditions	from -20...50 °C; 5...85% relative humidity; non-condensing gases, chemically non-aggressive conditions, fog, ice and frost (according EN IEC 60721-3-3 ed. 2:2019 climatic class 3K22, 1K21, 3M11) for installation at high altitude, it is necessary to consider the reduction of dielectric strength and a limited cooling air (EN IEC 60664-1 ed.3: 2020)

Terminals

Terminals and connectors:

F2A	Fuse F2A. Replace only with the same type if fuse broken.
G	power
G0	power
TE	optional connection for shielding
COM1 RS232	port COM1 - serial link RS232; CANNON 9 male
COM2 RS232	port COM2 - serial link RS232; CANNON 9 male
COM3 RS485	port COM3 - serial link RS485, terminals K+, K-
COM4 RS485	port COM4 - serial link RS485, terminals K+, K-

	Notice: Remember that **the internal I/O module is connected to COM3 on address 2**, and the COM3 port must be configured as Modbus RTU to reach the module.
Ethernet	network interface

Analogue inputs

AI1…8	**analogue inputs 1… 8** are designed as **passive only**. The range (0...1600 Ω (default), 0...5000 Ω, Pt1000) can be set over Domat IDE.

AI9…16	**analogue inputs 9…16**
	can be set so as to measure (when changing, it is necessary to write the settings to the RXIO module, solution tree on the left select the PLC -> channel -> RXIO right-click and choose Domat module configuration)
	   - **resistance** (same as AI1 to AI8),
	   - **voltage** 0...10 V (default) or
	   - **current** 0...20 mA.
	The AI9 to AI16 0...20 mA ranges are set using a DIP switch **for each input independently**. The jumpers are accessible from outside of the module.

Range	DIP switch
resistance, passive temperature sensors	OFF (default)
voltage 0...10 V	OFF (default)
current 0...20 mA	ON

AIC	**analogue inputs ground** (common for all AI) Notice: All analogue inputs AI1 to AI16 have common ground AIC. The inputs are optically separated from the other parts of the I/O module. For three-wire connection (active sensors, e.g. pressure, humidity), the analogue input ground AIC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the markMXL station.

Analogue outputs

AO1…8	**analogue outputs1…8** Notice: The outputs are short-circuit protected and optically separated from the other circuits in the module, and their ground (AOC) is not connected to the analogue inputs ground.
AOC	**analogue outputs ground** Notice: The ground is optically separated from the other parts of the I/O module. For three-wire connection (active periphery, e.g. valves actuators, frequency changer), the analogue input ground AOC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O

types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the markMXL station.

Digital inputs

DI1…32	**digital inputs DI1…32**
	Notice:
	Digital inputs operate with 24 V AC/DC. Each set of eight digital inputs have their own common COM terminals. The inputs are optically separated from the other circuits in the module, and they may be linked to the same transformer or power supply which supplies the markMXL station.
COM1	**digital inputs ground DI1…8**
	Notice:
	The ground is optically separated from the other parts of the I/O module.
COM2	**digital inputs ground DI9…16**
	Notice:
	The ground is optically separated from the other parts of the I/O module.
COM3	**digital inputs ground DI17…24**
	Notice:
	The ground is optically separated from the other parts of the I/O module.
COM4	**digital inputs ground DI25…32**
	Notice:
	The ground is optically separated from the other parts of the I/O module.

Digital outputs

DO1…32	**digital outputs 1…32**
	Notice:
	Digital outputs are normally open relays with maximum voltage 250 V, 5 A. Each pair of outputs has one common terminal (CX, Y). The statuses of the outputs are indicated by LEDs at the front panel of the module.
CX,Y	Common conductor for two neighbouring digital outputs with number X and Y.

LED indication

PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, …)
RUN RT	yellow LED – system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in other pattern, LED is permanently ON or OFF)
RUN IO	red LED - flashes: I/O module OK; OFF: error in the I/O module
RxD	green LED – receiving data at the respective COM (flashing: receiving data; OFF: no data traffic)
TxD	red LED – transmitting data at the respective COM (flashing: transmitting data; OFF: no data traffic)
LED DI1…32	Indication the statuses of the inputs (ON: voltage 24 AC/DC ±10 %; OFF: no or low voltage)

LED DO1…32	Indication the statuses of the outputs (ON: relay closed; OFF: relay open)

DIP switches

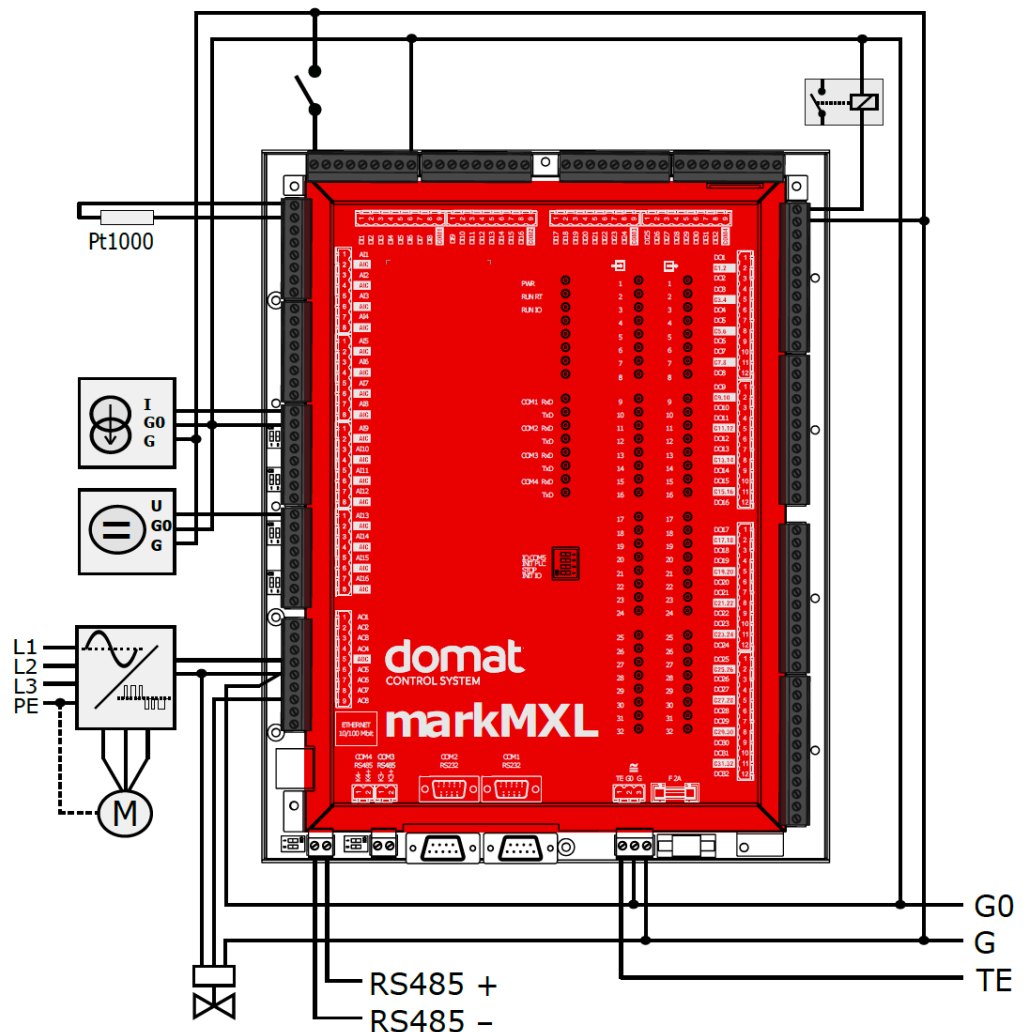| **IO COM5**	after switching DIP1 to the ON position, the internal I/O module communicates on the COM5 port at a speed of 9600 bit/s (you can set the speed up to 460800 bit/s). It is also necessary to change the settings of the given channel in the IDE and upload the project.
INIT PLC	if ON at power-up, configuration parameters are brought to defaults (see Configuration parameters in Domat IDE; for example IP address, user and password, database and proxy settings, etc.)
STOP	if ON runtime is running, program execution is stopped
INIT IO	if ON at power-up, communication parameters of the I/O module is set to 9600 bps, N, 8, 1
BUS END	DIP1 and DIP2 both set to ON = the respective RS485 bus is terminated, in the OFF position the terminating resistors are disconnected. The first and the last module on the bus should have the BUS END on. The DIP switch is accessible through a small aperture close to the K+, K- terminals.

Connection

Others

Ethernet

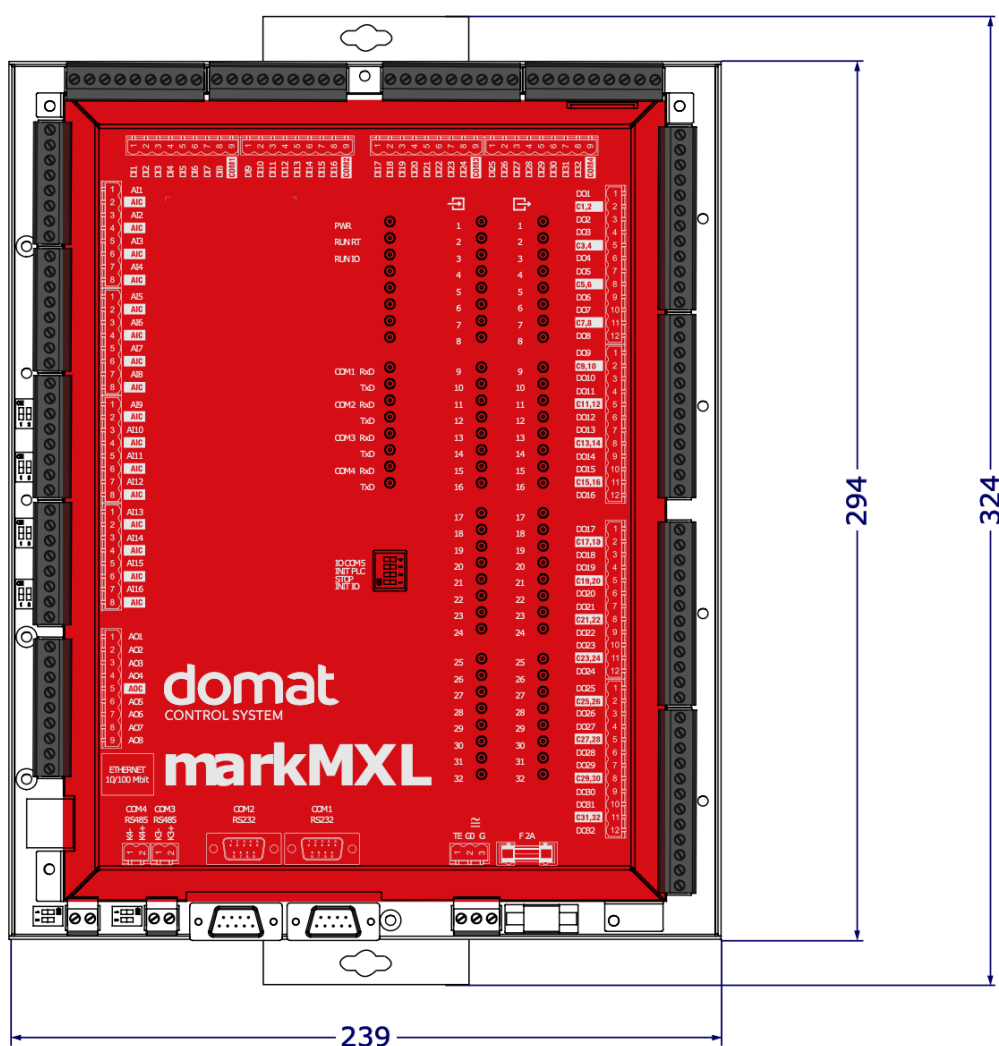The 10/100 Mbit/s Ethernet RJ45 connector links the markMXL to
- engineering notebook with Domat IDE
- web client (if web access is configured)
- RcWare Vision – SCADA
- other process stations for data exchange
- other clients
- the Internet for e-mail alarming.

Other topologies on request, contact Domat Control System technical support please.

Addressing

The Modbus address of the internal I/O module is set to 2, default communication parameters are 9600, 8, N, 1.

Dimensions

Dimensions are in *mm.*

Programming

Domat IDE

The main programming tool is the Domat package which contains I/O editor, graphical editor of the function plan (FBD), structure text editor and compiler (Domat IDE). The Domat package also contains LCD menu editor as well as web editor (Domat HMI).

The application program consists of function blocks which are stored in libraries. Those contain analogue and digital functions, mathematical blocks including goniometric functions, time schedulers, alarm blocks, and HVAC specific blocks (heat recovery, dewpoint calculation, enthalpy, pump switch etc.).

The minimum guaranteed number of records for history on the PLC is 37 000, but the actual number of stored samples may be larger depending on the data types that are stored in the history. The program can be set up also as structure text (ST) or with combination of both types of programming languages.

In case of implementation of your own ST driver, there is limitation of max. 10 clients connected simultaneously.

Communication Default network settings are:

IP address	192.168.1.10
subnet mask	255.255.255.0
default gateway	192.168.1.1

SSCP user: admin
Password: rw

Notice: Do not forget to record the new network settings after change!

After these values have been changed, it is possible to bring the process station into default settings by the INIT PLC DIP switch: set INIT to ON and restart the station. All values in the PLC configuration are set to defaults. The PLC will respond at the default IP address and it is possible to change the old address through Domat IDE.

The controllers can share variables over the Ethernet network (outside temperature, heat demands etc.) together with other PLC platforms.

The runtime provides drivers for communication with I/O modules and other subsystems. For example Domat runtime contains: Modbus TCP / RTU (server/client), M-Bus, IEC62056-21, SSCP, SoftPLC link and BACnet IP server/client (viz PICS). The complete list of drivers can be found in the Channel configuration dialogue in the most recent Domat release. Please check the required protocol features and functions with the list of implemented features in the Domat IDE help. It is also possible to program own communication drivers using the I/O library functions in structure text language.

Number of communication channels (on the serial lines and Ethernet) to I/O modules and subsystems is not directly restricted. It depends on available RAM PLC memory.

Number of connections from SSCP clients is max. 20. This includes connections from Domat IDE, Domat SCADA, HT200, mobile application Domat Visual, connection from other PLCs over SSCP etc.

Uploading a project from the Domat IDE reserves two SSCP TCP connections.

Number of connections from Modbus TCP clients on Modbus TCP server is max. 5.

Other clients channels (web, …) are not directly restricted.

WEEE notice   The device contains a non-rechargeable battery which backups the real-time clock and part of the memory. After the device is not operable, please return it to the manufacturer or dispose of it in compliance with local regulations.

Safety note   The device is designed for monitoring and control of heating, ventilation, and air conditioning systems. It must not be used for protection of persons against health risks or death, as a safety element, or in applications where its failure could lead to physical or property damage or environmental damage. All risks related to device operation must be considered together with design, installation, and operation of the entire control system which the device is part of.

Cyber security note
The product may influence the information and cyber security (ICS) of the control system. It is supplied in default settings. Implementation and continuous compliance with the ICS rules (e.g. creating and upload of certificates and keys, their updates and management, protection against misuse, etc.) are fully the responsibility of the control system operator. The manufacturer is not responsible for damages which originated or may originate due of wrong or insufficient implementation of ICS rules when using the device. In case of questions, please contact Domat Control System technical support.

Changes in versions

12/2023 – New datasheet version.
04/2024 – Addition of pin descriptions for CAN 9 (RS-232) ports.

ICIO205.2   DDC controller

Summary

DDC (Direct digital control) controller ICIO205.2 is free programmable process station with ARM i.MX6UL processor and OS Linux. It contains two Ethernet ports, 8 AI, 8 DI, 6 AO, 8 DO, RS485 interface and 128 MB external SRAM. ICIO205.2 is suitable for control of larger installations (approximately 400…500 physical data points).

Application

- **Free programmable control units for HVAC systems and other applications with web access**
- **Data acquisition, processing, and presentation systems with advanced networking features**
- **Protocol converters with web data presentation (must be programmed by user)**

Function

The controller hosts an embedded Linux operating system which boots up the Domat runtime with the application. The board contains real time clock with battery backup, flash memory containing OS, runtime, application, and other data (time programs, setpoints etc.), and a watchdog. It is also possible to use NVRAM to backup parameters in case of unexpected system shutdown.

The application is created and uploaded in the Domat IDE development environment. The maximum application program size depends on number of physical and software data points, amount of function blocks which require more memory (e.g. time schedulers), degree of code optimisation, and number of connections the PLC has to handle.

For communication with other devices, ICIO205.2 contains 2 × Ethernet port and 1 x RS485 interface for I/O module extension. I/Os integrated on the board are 8 × AI, 8 × DI, 6 × AO and 8 × DO.

ICIO205.2 has sufficient computing power to control larger installation with external I/O modules and communication channels (for example Modbus TCP server, or SSCP client).

The process station contains a web server for remote connection and user intervention. The web pages are created in Domat IDE which is also used for uploading the exported web definition to the process station. From the security point of view, the website is not recommended for use in the public network, it is intended for operation in a local network. Therefore, it is necessary to integrate the configured router or other element that ensures network security during the design of the network topology.

The module is 217 mm wide and mounts on a standard DIN rail.

Technical data		
Power	24 V AC/DC ± 20 %; max 10 W	
Communication		
Ethernet	2 × Ethernet 10/100BaseT	
	RJ45, 4 × LED (link, data, ETH 1, ETH 2) integrated in the connector	
RS485	COM1 RS485 (K+, K-)	
	galvanically insulated, insulating voltage 1 kV	
	300...115 200 bit/s, parity and bits are set in SW	
	maximal bus length 1200 m	
	maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications with ICIO205.2 use about 150 physical data points on the bus	
19 × LED	RUN, TxD, PWR, 8 × DI state, 8 × DO state	
Analogue inputs		
Number	8	
Resistance measuring range	0...1600 Ohm, 0...5000 Ohm, Pt100, Pt500, Pt1000, Ni1000-5000, Ni1000-6180 sensors (type of measuring is set using the Domat IDE, transformation is performed only at the application level in the PLC)	
Voltage measuring range	0...10 V DC (type of measuring is set using the Domat IDE)	
Current measuring range	0...20 mA	
	AI1...AI4: particular DIP switch must be in position ON	
	(type of measuring is set using the Domat IDE)	
	AI5...AI8: with an external resistor of 125 Ohm (parallel connection; type of measuring is set using the Domat IDE)	
Resolution	16 bit	
Galvanic insulation	optically insulated up to 1 kV	

Analogue outputs

Number	6
Voltage range	0…10 V DC
Analogue outputs load	min. 10 kΩ
	outputs are protected against permanent short-circuit – 10 mA limitation
Galvanic insulation	optically insulated up to 1 kV

Digital inputs

Number	8
Voltage	24 V AC/DC – voltage must be applied (no dry contacts), e.g. from G and G0
Input current	1.6 mA
Maximum voltage	60 V DC, 40 V AC
Max. switching frequency	10 Hz
Galvanic insulation	optically insulated up to 1 kV

Digital outputs

Number	6 × NO (normally open) relays (no voltage - open)
	2 × changing relays
NO relay load (DO 1 to 6)	5 A at 250 V AC, 1250 VA
	5 A at 30 V DC, 150 W
Changing relay load (DO 7 and 8)	8 A at 250 V AC, 2000 VA
	8 A at 24 V DC, 192 W
Galvanic insulation	optically insulated up to 1 kV
Standard type	AC1, non-inductive load EN 60947-4-1

HW	ARM i.MX6UL 528 MHz, 64 MB FLASH, 128 MB RAM, 128 kB NVRAM FRAM
SW	Domat IDE 2.4.0.19 and newer
Housing	steel, powder coated surface
Dimensions	217 × 115 × 40 mm (including terminals); See the schema below.
Protection degree	IP20 (EN 60529 + A2:2019)
Terminals	screw terminals M3, maximum wire cross-section 2.5 mm^2
Ambient conditions	from -20…50 °C; 5…85% relative humidity; noncondensing gases, chemically non-aggressive conditions, fog, ice, and frost (according EN IEC 60721-3-3 ed. 2:2019 climatic class 3K22, 1K21, 3M11)

for installation at high altitude, it is necessary to consider the reduction of dielectric strength and a limited cooling air (EN IEC 60664-1 ed.3: 2020)
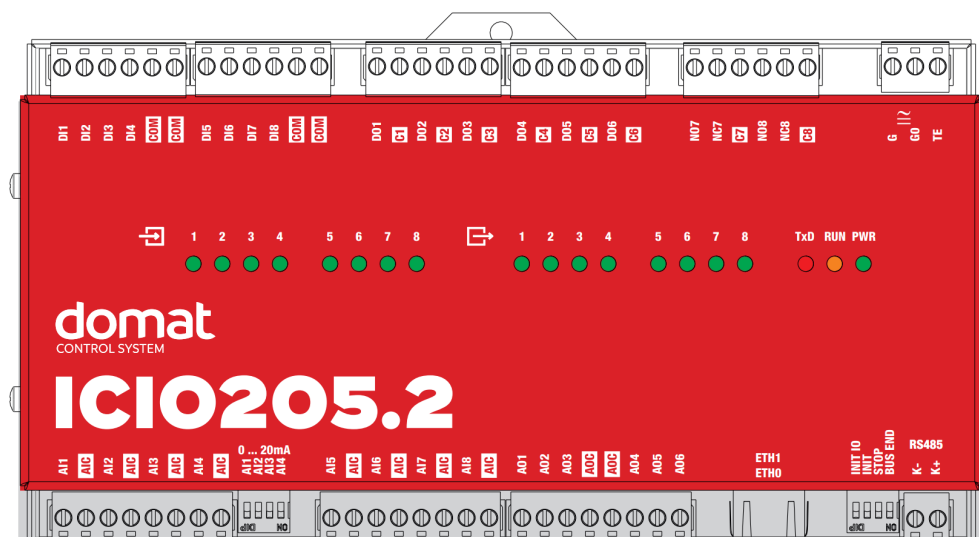
Standards of conformity	EMC EN IEC 61000-6-2 ed.4:2019, EN IEC 61000-6-4 ed.3:2019 (industrial environment)
	Electrical safety EN IEC 62368-1 ed.2:2020 + A11:2020
	Hazardous substances reduction EN IEC 63000:2019

Terminals

Terminals and connectors

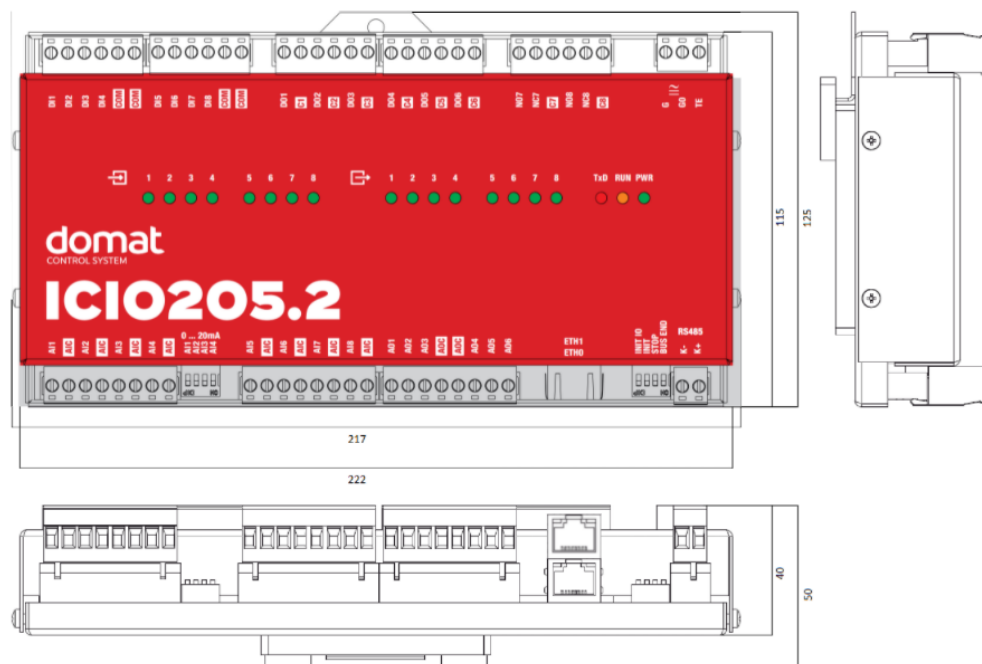|	
DI1…8	digital inputs 1…8
COM	ground (common)
DO1…6	relay output 1…6, normally open against C1…C6
C1…6	relay output 1…6, ground
NO7	relay output 7, normally open against C7
NC7	relay output 7, normally closed against C7
C7	relay output 7, ground
NO8	relay output 8, normally open against C8
NC8	relay output 8, normally closed against C8
C8	relay output 8, ground
G	power
G0	power
TE	optional connection for shielding
AI1…8	analogue inputs 1…8
AIC	**analogue input ground** (common)
	Notice:
	All analogue inputs AI1 to AI8 have common ground AIC. The inputs are optically separated from the other parts of the I/O module. For three-wire connection (active sensors, e.g. pressure, humidity), the analogue input ground AIC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the ICIO module.

AO1…6		analogue outputs 1…6
AOC		**analogue output ground** (common)

Notice:

The ground is optically separated from the other parts of the I/O module. For three-wire connection (active periphery, e.g. valves actuators, frequency changer), the analogue output ground AOC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the ICIO module.

Ethernet	network interface
RS485	port COM1 – serial line RS485, terminals K+, K-

LED indication

LED DI1…8	indication the statuses of the inputs (ON: voltage 24 AC/DC ± 10 %; OFF: no or low voltage)
LED DO1…8	indication the statuses of the outputs (ON: relay closed; OFF: relay open)
TxD	red LED – M-bus transmitting data at COM1 (flashing: receiving data; still ON: shortcircuited bus or bus overload)
RUN	yellow LED – system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in other pattern, LED is permanently ON or OFF)
PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, …)

DIP switches

STOP	if ON, the runtime is running, program execution is stopped
INIT	if ON at power-up, configuration parameters are brought to defaults (see Configuration parameters in Domat IDE; e.g. IP address, user and password, database settings, proxy, …)
BUS END	2 Switches for bus RS485 termination (located at the RS485 connector); ON = bus end; the first and last devices on bus should have bus end ON
AI1…4	if ON, the parallel resistance 125 Ohm is connected and input is ready for current measuring

Connection
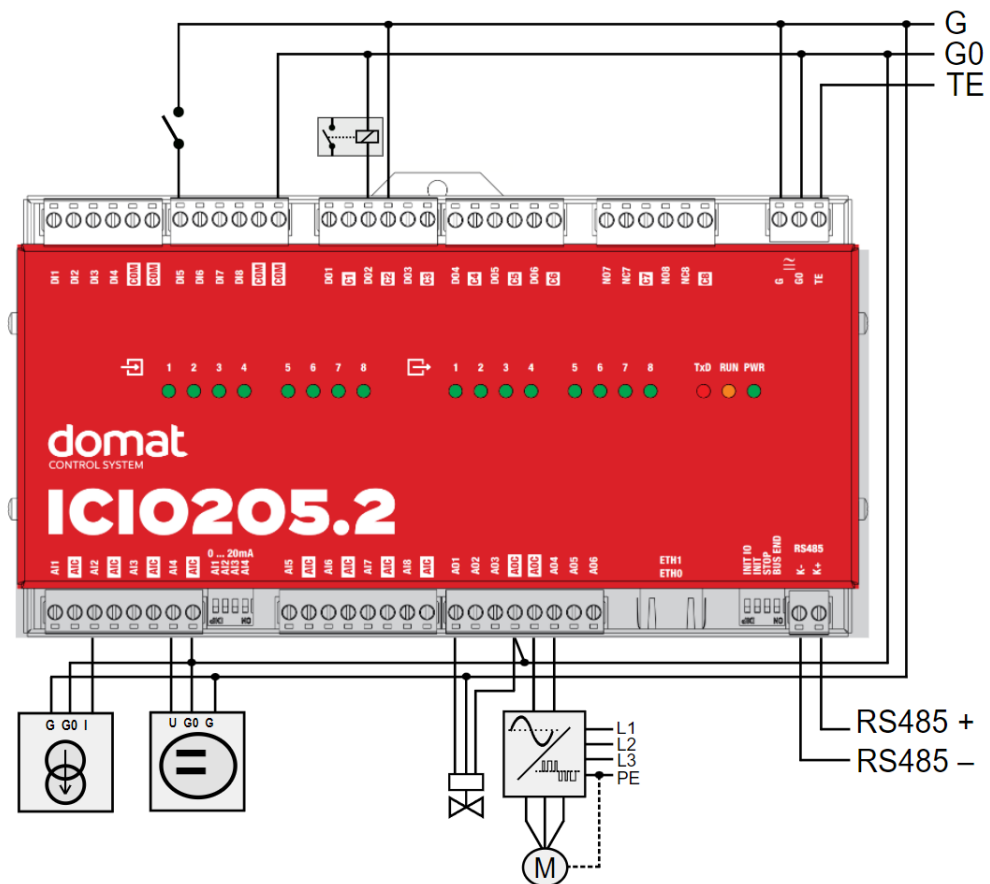
Resistive (passive) sensors are connected between AIx and AIC terminals, for the first 4 inputs must be DIP switch 0...20 mA in the off position. The resistance range is set in the software.

Dimensions

Dimensions are in *mm*.

Programming   **Domat IDE**

Programming tool Domat IDE contains I/O editor, graphical editor of the function plan (FBD), structure text editor, web page editor and LCD menu editor (HMI) for PLC and compiler.

The application program consists of function blocks which are stored in libraries. Those contain analogue and digital functions, mathematical blocks including goniometric functions, time schedulers, alarm blocks, and HVAC specific blocks (heat recovery, dewpoint calculation, enthalpy, pump switch etc.). In addition to function blocks, the application program can also be compiled from structured text, or a combination of both languages can be used.

The minimum guaranteed number of records for history on the PLC is 79 000, but the actual number of stored samples may be larger depending on the data types that are stored in the history.

Communication   Default network settings are:

IP address: 192.168.1.10
subnet mask: 255.255.255.0
default gateway: 192.168.1.1

SSCP user: admin
Password: rw

Notice: Do not forget to record the new network settings after change!

After these values have been changed, it is possible to bring the process station into default settings by the INIT DIP switch: set INIT to ON and restart the station. All values in the PLC configuration are set to defaults. The PLC will respond at the default IP address and it is possible to change the old address through Domat IDE.

The controllers can share variables over the Ethernet network (outside temperature, heat demands etc.) together with other PLC platforms.

The runtime provides drivers for communication with I/O modules and other subsystems which communicates e.g. through Modbus TCP/RTU (server/client), M-Bus, IEC62056-21, SSCP, SoftPLC link and BACnet IP server/client (see PICS). The complete list of drivers can be found in the Channel configuration dialogue in the most recent Domat release. Please check the required protocol features and functions with the list of implemented features in the Domat IDE help. It is also possible to program own communication drivers using the I/O library functions in structure text language.

Number of communication channels (on the serial lines and Ethernet) to I/O modules and subsystems is not directly restricted. It depends on available RAM PLC memory.

Number of connections from SSCP clients is max. 5. This includes connections from RcWare Vision, Domat IDE, HT102/200, mobile application Domat Visual, connection from other PLCs over SSCP etc.

Number of connections from Modbus TCP clients on Modbus TCP server is max. 5.

In case of implementation of your own ST driver, there is limitation of max. 10 clients connected simultaneously.

Other clients channels (web, …) are not directly restricted.

WEEE notice	The device contains a non-rechargeable battery which backups the real-time clock and part of the memory. After the device is not operable, please return it to the manufacturer or dispose of it in compliance with local regulations.
Safety note	The device is designed for monitoring and control of heating, ventilation, and air conditioning systems. It must not be used for protection of persons against health risks or death, as a safety element, or in applications where its failure could lead to physical or property damage or environmental damage. All risks related to device operation must be considered together with design, installation, and operation of the entire control system which the device is part of.

Cyber security note
The product may influence the information and cyber security (ICS) of the control system. It is supplied in default settings. Implementation and continuous compliance with the ICS rules (e.g. creating and upload of certificates and keys, their updates and management, protection against misuse, etc.) are fully the responsibility of the control system operator. The manufacturer is not responsible for damages which originated or may originate due of wrong or insufficient implementation of ICS rules when using the device. In case of questions, please contact Domat Control System technical support.

Changes in versions	07/2022 – First datasheet version.
	09/2022 – Addition of information on AOC, AIC, flash memory size correction.
	08/2023 – Change of names from Merbon to Domat

mark130.2   DDC controllers

Summary

DDC (Direct digital control) controller mark130.2 is free programmable process station with ARM i.MX6UL processor and OS Linux. It is suitable for control of larger installation or use like control panel for other mark process station with Domat runtime. Mark130.2 contains 1 × Ethernet port, 1 × RS485 interface, 1 × RS232 interface and external 128 MB SRAM.

Application

- **Control panel incl. mark process station with Domat runtime for HVAC systems or other technologies**
- **Free programmable control units for small HVAC systems and other applications**

Function

The controller hosts an embedded Linux operating system which boots up the Domat runtime with the application. The board contains real time clock with battery backup, flash memory containing OS, runtime, application, and other data (time programs, setpoints etc.), and a watchdog. It is also possible to use NVRAM to backup parameters in case of unexpected system shutdown.

The application is created and uploaded in the Domat IDE development environment. The maximum application program size depends on number of physical and software data points, amount of function blocks which require more memory (e.g. time schedulers), degree of code optimisation, and number of connections the PLC has to handle.

For communication with other devices, mark130.2 contains 1 × Ethernet port, 1 × a RS485 interface and 1 × a RS232 interface.

The process station contains a web server for remote connection and user intervention. The web pages and LDC menu are created and uploaded to the process station through Domat IDE. From the security point of view, the website is not

recommended for use in the public network, it is intended for operation in a local network. Therefore it is necessary to integrate the configured router or other element that ensures network security during the design of the network topology.

The process station can be operated through a 4 × 20 characters backlit LCD display and 6 pushbuttons. Users move in the menu using buttons – the **active row is the second row** from the top, which is enhanced by the red line on the printed cover. Objects such as Value setting, Alarm, and Time schedule have predefined functionality, and thus for the configuration it is only necessary to set addresses, assign data points, and complete user texts.

The user menu structure is configured and uploaded to the process station through Domat IDE (see LCD menu definition in PLC properties).
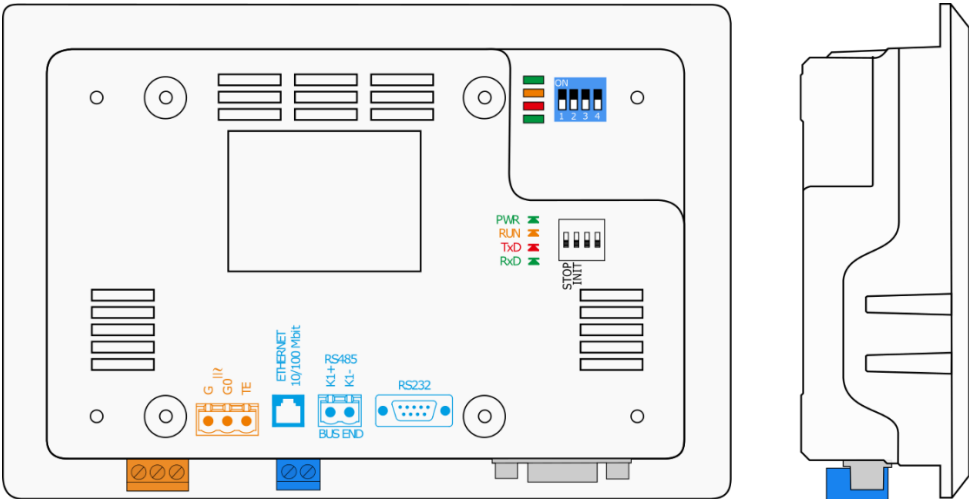
The device is installed using three plastic clamps into an aperture in panel door or any suitable box. The aperture dimensions are 153 × 100 mm, with tolerance 2 mm.

Technical data Power	24 V AC/DC ± 20 %; max. 5 W
Communication	
Ethernet	1 × Ethernet 10/100BaseT
	RJ45, 2 LED (link, data) integrated in the connector
RS232	COM2
	1 × CANNON 9 male; pin 2=RX, 3=TX, 4=DSR, 5=GND, 6=DTR, 7=RTS, 8=CTS
	galvanically insulated, insulating voltage 1 kV
	300...115 200 bit/s, parity and bits are set in SW
RS485	COM1 RS485 (K+, K-)
	galvanically insulated, insulating voltage 1 kV
	300...115 200 bit/s, parity and bits are set in SW
	maximal bus length 1200 m
	maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications use about 300...400 physical data points on the bus
LCD display	4 rows × 20 characters, blue backlight
	possibility to switch off the backlight through application software
Buttons	6 buttons on a membrane keyboard, water and dirt resistant
4 × LED	PWR, RUN, RS485 TxD/RxD
HW	ARM i.MX6UL 528 MHz, 64 MB FLASH, 128 MB RAM, 128 kB NVRAM FRAM
SW	Domat IDE

Housing	polycarbonate (PC) box (UL94V-2); front panel polyester membrane keypad
Front panel dimensions	171.8 × 116.5 × 39.3 mm; see scheme below
Aperture dimensions	153 × 100 mm (deviation +2 mm)
Front protection degree	IP65 (EN 60529 + A2:2019)
Terminals	screw terminals M3, recommended wire diameter 0.35...1.5 mm^2
Ambient temperature	from -20...50 °C; 5...85% relative humidity; non-condensing gases, chemically non-aggressive conditions, fog, ice, and frost (according EN IEC 60721-3-3 ed. 2:2019 climatic class 3K22, 1K21, 3M11)
	for installation at high altitude, it is necessary to consider the reduction of dielectric strength and a limited cooling air (EN IEC 60664-1 ed.3: 2020)
Standards of conformity	EMC EN IEC 61000-6-2 ed. 4:2019, EN IEC 61000-6-4 ed. 3:2019 (industrial environment)
	Electrical safety EN IEC 62368-1 ed. 2:2020+A11:2020
	Hazardous substances reduction EN IEC 63000:2019

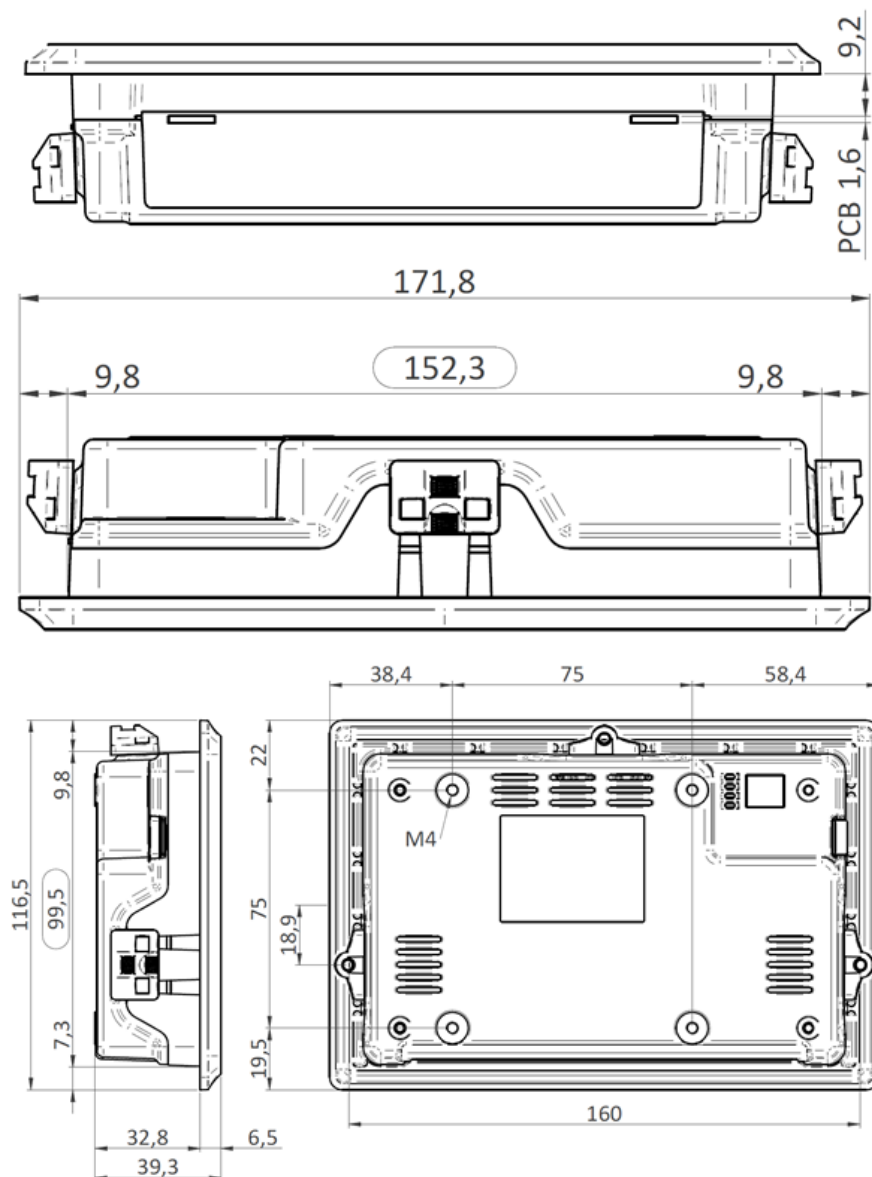**Terminals**

Terminals and connectors

G	power
G0	power
TE	optional connection for shielding
Ethernet	network interface
RS232	port COM2 - serial link RS232; CANNON 9 male
RS485	port COM1 - serial link RS485, terminals K+, K-

LED indication

PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, ...)
RUN	orange LED – system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in other pattern, LED is still ON or OFF)

TxD	red LED – RS485 transmitting data at COM1 (flashing: transmitting data; OFF: no data traffic)
RxD	green LED – RS485 receiving data at COM1 (flashing: receiving data; OFF: no data traffic)

DIP switches

STOP	DIP1 if ON runtime is running, program execution is stopped
INIT	DIP2 if ON at power-up, configuration parameters are brought to defaults (see Configuration parameters in Domat IDE; for example IP address, user and password, database settings, proxy, …)
BUS END	If ON = bus end COM1; the first and last devices on bus should have bus end ON; switch is under the RS485 terminals

Dimensions

Dimensions are in *mm*.

Programming   **Domat IDE**

Programming tool Domat IDE contains I/O editor, graphical editor of the function plan (FBD), structure text editor, web page editor and LCD menu editor (HMI) for PLC and compiler.

The application program consists of function blocks which are stored in libraries. Those contain analogue and digital functions, mathematical blocks including goniometric functions, time schedulers, alarm blocks, and HVAC specific blocks (heat recovery, dewpoint calculation, enthalpy, pump switch etc.). In addition to function blocks, the application program can also be compiled from structured text, or a combination of both languages can be used.

The minimum guaranteed number of records for history on the PLC is 79 000, but the actual number of stored samples may be larger depending on the data types that are stored in the history. The program can be set up also as structure text (ST) or with combination of both types of programming languages.

Communication   Default network settings are:

IP address   192.168.1.10
subnet mask   255.255.255.0
default gateway   192.168.1.1

SSCP user: admin
Password: rw

Notice: Do not forget to note the new network settings after change!

After these values have been changed, it is possible to bring the process station into default settings by the INIT DIP switch: set INIT to ON and restart the station. All values in the PLC configuration are set to defaults. The PLC will respond at the default IP address and it is possible to change the old address through Domat IDE.

The controllers can share variables over the Ethernet network (outside temperature, heat demands etc.) together with other PLC platforms.

The runtime provides drivers for communication with I/O modules and other subsystems. For example Domat runtime contains: Modbus TCP / RTU (server/client), M-Bus, IEC62056-21, SSCP, SoftPLC link and BACnet IP server/client (viz PICS). The complete list of drivers can be found in the Channel configuration dialogue in the most recent Domat release. Please check the required protocol features and functions with the list of implemented features in the Domat IDE help. It is also possible to program own communication drivers using the I/O library functions in structure text language.

Number of communication channels (on the serial lines and Ethernet) to I/O modules and subsystems is not directly restricted. It depends on available RAM PLC memory.

Number of connections from SSCP clients is max. 5. This includes connections from RcWare Vision, Domat IDE, HT102/HT104/200, mobile application Domat Menu Reader, connection from other PLCs over SSCP etc.

Number of connections from Modbus TCP clients on Modbus TCP server is max. 5.

In case of implementation of your own ST driver, there is limitation of max. 10 clients connected simultaneously.

Other clients channels (web, …) are not directly restricted.

WEEE notice The device contains a non-rechargeable battery which backups the real-time clock and part of the memory. After the device is not operable, please return it to the manufacturer or dispose of it in compliance with local regulations.

Safety note The device is designed for monitoring and control of heating, ventilation, and air conditioning systems. It must not be used for protection of persons against health risks or death, as a safety element, or in applications where its failure could lead to physical or property damage or environmental damage. All risks related to device operation must be considered together with design, installation, and operation of the entire control system which the device is part of.

Changes in versions

07/2022 – First version of datasheet.
09/2022 – Flash memory size correction.
08/2023 – Change of names from Merbon to Domat.
04/2024 – Addition of pin descriptions for CAN 9 (RS-232) ports.

mark320LX
mark220LX

DDC controllers

Summary

DDC (Direct digital control) controllers mark320LX and mark220LX are free programmable process stations on i.MX platform with an ARM Cortex A7 processor and OS Linux. They are suitable for control of large installation (approximately 400 – 500 physical data points). Mark320LX contains 1 × Ethernet port, 2 × RS485 interface, and 2 × RS232 interface for connecting I/O modules. Mark220LX contains only 1 × Ethernet port and 1 × RS485 interface.

Application

- **Free programmable control units for HVAC systems and other applications with local HMI and web access**
- **Data acquisition, processing, and presentation systems with advanced networking features**
- **Controls of power systems, photovoltaic power plants etc.**
- **Protocol converters with web data presentation (must be programmed by user)**

Function

The controller hosts an embedded Linux operating system which boots up the Merbon runtime with the application. The board contains real time clock with battery backup, flash memory containing OS, runtime, application, and other data (time programs, setpoints etc.), and a watchdog. It is also possible to use NVRAM to backup parameters in case of unexpected system shutdown.

The application is created and uploaded in the Merbon IDE development environment. The maximum application program size depends on number of physical and software data points, amount of function blocks which require more memory (e.g. time schedulers), degree of code optimisation, and number of connections the PLC has to handle.

For communication with other devices, mark320LX contains 1 × Ethernet port, 2 × a RS485 interface and 2 × a RS232 interface. The mark220LX contains only 1 × Ethernet port and 1 × a RS485 interface.

The process station contains a web server for remote connection and user control. The web pages are created in Merbon IDE through which is then web definition uploaded to the process station (see Web definition in PLC properties). Web is not recommended for safety reasons to use in free Internet. It is designed to operate on a local network. In the network topology design is therefore expected to be pre-configured router or any other element that provides network security.

The process station can be operated through a 3 × 16 characters backlit LCD display and 6 backlit pushbuttons. Users move in the menu using buttons – the **active row is the middle row**. Objects such as Value setting, Alarm, and Time schedule have predefined functionality, and thus for the configuration it is only necessary to set addresses, assign data points, and complete user texts.

The user menu structure is configured and uploaded to the process station through Merbon IDE (see LCD menu definition in PLC properties).

The module is 105 mm wide and mounts on a standard DIN rail. MarkPLC kit for mounting into an aperture in panel door or any suitable box can be ordered.

Technical data		
	Power	24 V AC/DC ± 20 %; 6 W
	Communication mark320LX	
	Ethernet	1 × Ethernet 10/100BaseT
		RJ45, 2 LED (link, data) integrated in the connector
	RS232	COM1, COM2
		2 × CANNON 9 male; pin 2=TX, 3=RX, 5=GND
		300...115 200 bit/s, parity and bits are set in SW
	RS485	COM3, COM4 RS485 (K+, K-)
		2 separated buses galvanically insulated from each other, insulating voltage 1 kV
		300...115 200 bit/s, parity and bits are set in SW
		maximal bus length 1200 m
		maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications use about 300...400 physical data points on the bus
	Communication mark220LX	
	Ethernet	1 × Ethernet 10/100BaseT
		RJ45, 2 LED (link, data) integrated in the connector
	RS485	COM4 RS485 (K+, K-)
		1 bus; galvanically insulated, insulating voltage 1 kV
		300...115 200 bit/s, parity and bits are set in SW
		maximal bus length 1200 m
		maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC

applications use about 300…400 physical data points on the bus

LCD display	3 rows × 16 characters, blue backlight
	manually adjustable backlight intensity
	possibility to switch off the backlight through application software
Buttons	6 backlit buttons
6× LED – mark320LX	RUN, PWR, 2× RS485 RxD/TxD
4× LED – mark220LX	RUN, PWR, RS485 RxD/TxD
HW	ARM i.MX6UL 528 MHz, 128 MB FLASH, 128 MB SRAM, 128 KB NVRAM
SW	Merbon IDE
Housing	polycarbonate box (certification UL94V0)
Dimensions	105.6 × 98.7 × 61.4 mm
Aperture dimensions	102(width) × 45 (high) mm; tolerance +1 mm
Protection degree	IP20 (EN 60529+A1+A2)
Terminals	screw terminals M3, recommended wire diameter 0.35…1.5 mm^2
Ambient temperature	from -20…50 °C; 5…85% relative humidity; non-condensing gases, chemically non-aggressive conditions, fog, ice and frost (according EN IEC 60721-3-3 ed. 2:2019 climatic class 3K22, 1K21, 3M11)
	for installation at high altitude, it is necessary to consider the reduction of dielectric strength and a limited cooling air (EN IEC 60664-1 ed.3: 2020)
Standards of conformity	EMC EN IEC 61000-6-2 ed. 4:2019, EN IEC 61000-6-4 ed. 3:2019 (industrial environment)
	electrical safety EN IEC 62368-1 ed. 2:2020+A11:2020
	hazardous substances reduction EN IEC 63000:2019
Accessories	markPLCkit – frame for mounting mark320LX into an aperture in panel door or any suitable box
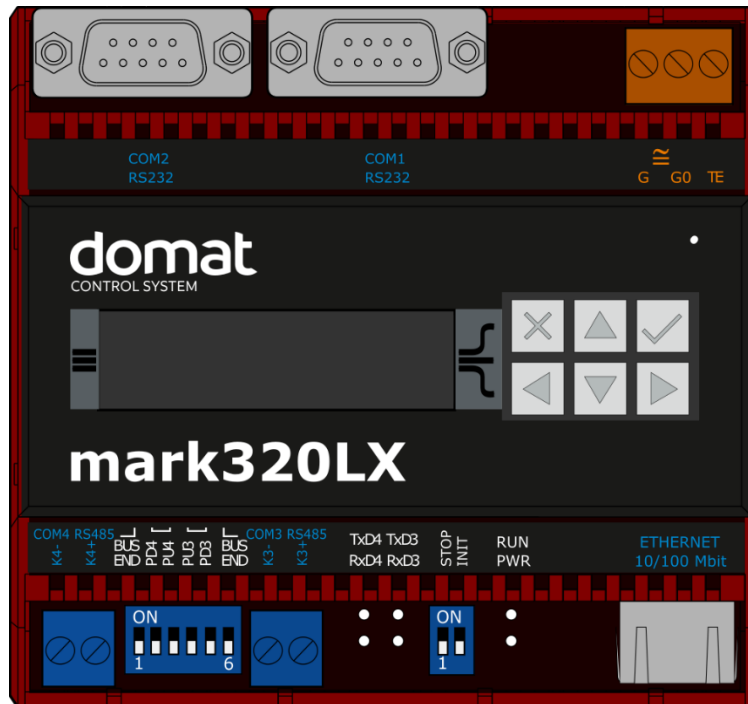
Terminals

Terminals and connectors

COM1	port COM1 - serial link RS232; CANNON 9 male (**mark320LX only**)
COM2	port COM2 - serial link RS232; CANNON 9 male (**mark320LX only**)
COM3	port COM3 - serial link RS485, terminals K+, K- (**mark320LX only**)
COM4	port COM4 - serial link RS485, terminals K+, K-
Ethernet	network interface
G	power
G0	power
TE	optional connection for shielding (on the back side in the DIN rail groove there is a metal strip which connects TE to DIN rail after the device is snapped on the rail)

LED indication

RUN	green LED – system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in other pattern, LED is still ON or OFF)
PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, …)
RxD3	green LED – RS485 receiving data at COM3 (flashing: receiving data; OFF: no data traffic)(**mark320LX only**)
TxD3	red LED – RS485 transmitting data at COM3 (flashing: transmitting data; OFF: no data traffic)(**mark320LX only**)
RxD4	green LED – RS485 receiving data at COM4 (flashing: receiving data; OFF: no data traffic)
TxD4	red LED – RS485 transmitting data at COM4 (flashing: transmitting data; OFF: no data traffic)

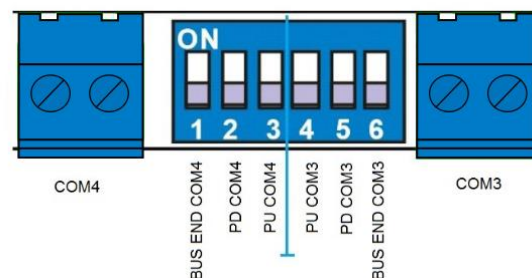|	**DIP switches**	
	STOP	if ON runtime is running, program execution is stopped
	INIT	if ON at power-up, configuration parameters are brought to defaults (see Configuration parameters in Merbon IDE; for example IP address, user and password, database settings, proxy, …)
	BUS END	(DIP6 next to COM3 RS485) bus end COM3; the first and last devices on bus should have bus end ON
	BUS END	(DIP1 next to COM4 RS485) bus end COM4; the first and last devices on bus should have bus end ON
	PU3	pull-up resistor for COM3
	PD3	pull-down resistor for COM3
	PU4	pull-up resistor for COM4
	PD4	pull-down resistor for COM4

DIP BUS END, PU/PD

Bus End and pull up / pull down switches:

Three switches on the left belong to COM4, three switches on the right belong to COM3.

Unlike for the other modules and controllers, the bus is terminated (BUS END) with one switch only (SW1 and SW6).
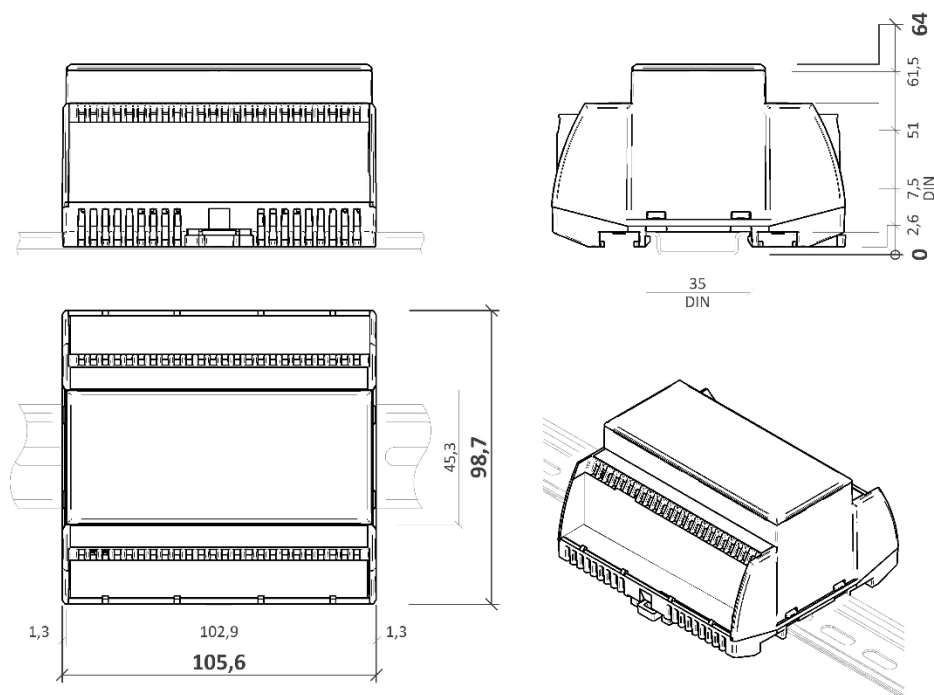
The inner switches (2 and 3 for COM4, 4 and 5 for COM3) are pull-up and pull-down switches for K+, and K- wires:

The K- signal is bound over a resistor to RS485 ground (PD switch), the K+ links over a resistor to +5V power of the bus driver (PU switch).

Unlike at the older PLC versions, the RS485 buses are separated from each other. It is possible to activate all PU and PD switches at the same time.

Dimensions

Dimensions are in *mm*.

Programming   **Merbon IDE**

Programming tool Merbon IDE contains I/O editor, graphical editor of the function plan (FBD), structure text editor, web page editor and LCD menu editor (HMI) for PLC and compiler.

The application program consists of function blocks which are stored in libraries. Those contain analogue and digital functions, mathematical blocks including goniometric functions, time schedulers, alarm blocks, and HVAC specific blocks (heat recovery, dewpoint calculation, enthalpy, pump switch etc.). In addition to function blocks, the application program can also be compiled from structured text, or a combination of both languages can be used.

The minimum guaranteed number of records for history on the PLC is 37 000, but the actual number of stored samples may be larger depending on the data types that are stored in the history

Communication   Default network settings are:

IP address	192.168.1.10
subnet mask	255.255.255.0
default gateway	192.168.1.1

SSCP user: admin
Password: rw

Notice: Do not forget to note the new network settings after change!

After these values have been changed, it is possible to bring the process station into default settings by the INIT DIP switch: set INIT to ON and restart the station. All values in the PLC configuration are set to defaults. The PLC will respond at the default IP address and it is possible to change the old address through Merbon IDE.

The controllers can share variables over the Ethernet network (outside temperature, heat demands etc.) together with other PLC platforms.

The runtime provides drivers for communication with subsystems. For example Merbon runtime contains: Modbus TCP / RTU (server/client), M-Bus, IEC62056-21, SSCP, and SoftPLC link. The complete list of drivers can be found in the Channel configuration dialogue in the most recent Merbon release. Please check the required protocol features and functions with the list of implemented features in the Merbon IDE help. It is also possible to program own communication drivers using the I/O library functions in structure text language.

Number of communication channels (on the serial lines and Ethernet) to I/O modules and subsystems is not directly restricted. It depends on available RAM PLC memory.

Number of connections from SSCP clients is max. 20. This includes connections from Merbon IDE, Merbon SCADA, HT104/200, mobile application Merbon Visual, connection from other PLCs over SSCP etc.

Number of connections from Modbus TCP clients on Modbus TCP server is max. 5.

In case of implementation of your own ST driver, there is limitation of max. 10 clients connected simultaneously.

Uploading a project from the Merbon IDE reserves two SSCP TCP connections.

Other clients channels (web, …) are not directly restricted.

WEEE notice   The device contains a non-rechargeable battery which backups the real-time clock and part of the memory. After the device is not operable, please return it to the manufacturer or dispose of it in compliance with local regulations.

Safety note   The device is designed for monitoring and control of heating, ventilation, and air conditioning systems. It must not be used for protection of persons against health risks or death, as a safety element, or in applications where its failure could lead to physical or property damage or environmental damage. All risks related to device operation must be considered together with design, installation, and operation of the entire control system which the device is part of.

Changes in versions	07/2021 – First version of datasheet.
	03/2022 – Logo change, stylistic modifications, added information about limiting the number of simultaneously connected clients.

IMIO105.2
IMIO110.2
DDC controllers

Summary

DDC (Direct digital control) controllers IMIO105.2 and IMIO110.2 are free programmable process station with ARM i.MX6UL processor and Linux OS. It contains two Ethernet ports, 4 × AI, 4 × DI, 2 × AO, 6 × DO and RS485 interface. Controllers are suitable for control of larger installations (approximately 400 to 500 physical data points).
IMIO110.2 also contains LCD display and 6 buttons.

Application

- Free programmable control units for HVAC systems and other applications with web access
- Data acquisition, processing, and presentation systems with advanced networking features
- Protocol converters with web data presentation (must be programmed by user)

Function

The controller hosts an embedded Linux operating system which boots up the Merbon runtime with the application. The board contains real time clock with battery backup, flash memory containing OS, runtime, application, and other data (time programs, setpoints etc.), and a watchdog. It is also possible to use NVRAM to backup parameters in case of unexpected system shutdown.

The application is created and uploaded in the Merbon IDE development environment. The maximum application program size depends on number of physical and software data points, amount of function blocks which require more memory (e.g. time schedulers), degree of code optimisation, and number of connections the PLC has to handle.

For communication with other devices, IMIOs contain two Ethernet ports. I/Os integrated on the board are 4v AI, 2 × AO, 4 × DI and 6 × DO and RS485 interface.

Controllers have sufficient computing power to control larger installation with external I/O modules and communication channels (for example Modbus TCP server, SSCP client, …).

The process station contains a web server for remote connection and user intervention. The web pages are created in Merbon IDE which is also used for uploading the exported web definition to the process station. From the security point of view, the website is not recommended for use in the public network, it is intended for operation in a local network., Therefore it is necessary to integrate the configured router or other element that ensures network security during the design of the network topology.

IMIO110.2 process station can be operated through a 3 × 16 characters backlit LCD display and 6 backlit pushbuttons. Users move in the menu using buttons – the **active row** is the **middle row**. Objects such as Value setting, Alarm, and Time schedule have predefined functionality, and thus for the configuration it is only necessary to set addresses, assign data points, and complete user texts. The user menu structure is configured and uploaded to the process station through Merbon IDE (see LCD menu definition in PLC properties)

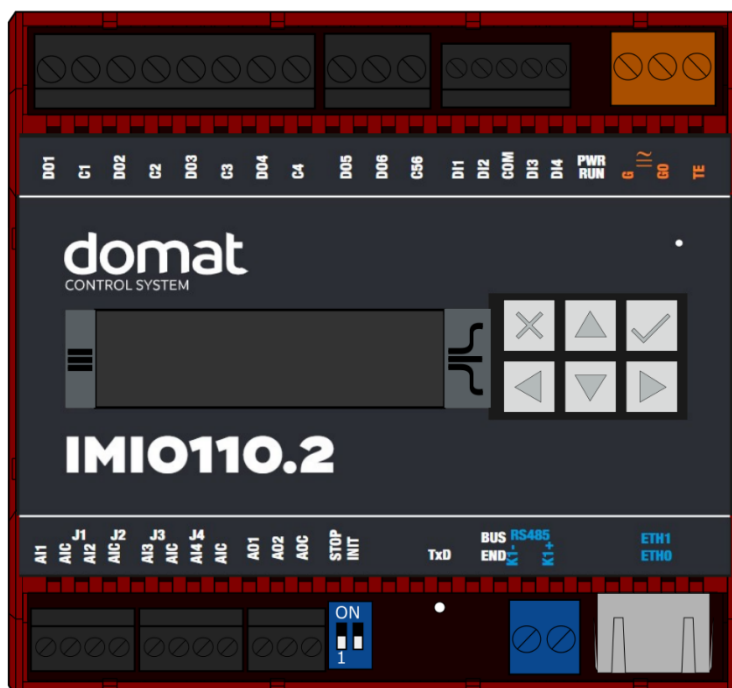Modules are 105 mm wide and mounts on a standard DIN rail.

Technical data		
	Power	24 V AC/DC ± 20 %; max 5 VA
	Communication	
	Ethernet	2 × Ethernet 10/100BaseT
		RJ45, 4 × LED (link, data, ETH 1 and 2) integrated in the connector
	RS485	COM1 RS485 (K+, K-)
		galvanically insulated, insulating voltage 1 kV
		300...115 200 bit/s, parity and bits are set in software
		maximal bus length 1200 m
		maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications with IMIOs use about 400 physical data points on the bus
	LCD display (IMIO110.2 only)	3 rows × 16 characters, blue backlight
		adjustable backlight intensity
		possibility to switch off the backlight through application software
	Buttons (IMIO110.2 only)	6 backlit buttons
	3 × LED	RUN - yellow, TXD - red, PWR - green
	Analogue inputs	
	Number	4

Resistance measuring range	0...1600 Ohm, 0...5000 Ohm, Pt100, Pt500, Pt1000, Ni1000-5000, Ni1000-6180... sensors (transformation is performed only at the application level in the PLC), settings see in Terminals -> Jumpers
	Measuring current in the passive mode (0...1600 Ohm): 200 µA at 100 % of the time.
Voltage measuring range	Only AI3, AI4: 0...10 V DC (settings see in Terminals -> Jumpers)
Current measuring range	Only AI3, AI4: with an external resistor of 125 Ohm as 0...20 mA
Input resistance	10 kOhm
Resolution	16 bit
Galvanic insulation	optically insulated up to 1 kV
Analogue outputs	
Number	2
Voltage range	0...10 V DC
Analogue outputs load	min. 10 kΩ
	outputs are protected against permanent short-circuit – 20 mA limitation
Resolution	8 bit
Galvanic insulation	optically insulated up to 1 kV
Digital inputs	
Number	4
Voltage	24 V AC/DC – voltage must be applied (no dry contacts), e.g. from G and G0
Input current	4 mA
Logical level	log. 0 - (<5 V)
	log. 1 - (>18 V)
Maximal voltage	60 V DC, 40 V AC
Max. switching frequency	10 Hz
Galvanic insulation	optically insulated up to 1 kV
Digital outputs	
Number	4 relays, normally open
	2 solid state relays
Relay load	5 A at 250 V AC, 1250 VA
(DO 1 to 4)	5 A at 30 V DC, 150 W
Solid state relay load	For AC and DC load, 24 V DC/AC, maximum current 0.4 A

(DO 5 and 6)	Recommended thermic actuators are STA71 (Siemens), TWA (the 24 V types, Danfoss).
Galvanic insulation	optically insulated up to 1 kV
CPU	ARM i.MX6UL 528 MHz, 128 MB FLASH, 128 MB SRAM, 128 KB NVRAM
SW	Merbon IDE 2.4.0.19 and newer
Housing	Polycarbonate box (certification UL94V0)
Dimensions	105 × 98 × 64 mm
Protection degree	IP20 (EN 60529 + A2:2019)
Terminals	Power, RS485, DO: screw terminals M3, maximum wire cross-section 2.5 mm^2
	AO/AI/DI: screw terminals M2, maximum wire cross-section 1.5 mm^2
Ambient conditions	from -20…50 °C; 5…85% relative humidity; non-condensing gases, chemically non-aggressive conditions, fog, ice and frost (according EN IEC 60721-3-3 ed. 2:2019 climatic class 3K22, 1K21, 3M11)
	for installation at high altitude, it is necessary to consider the reduction of dielectric strength and a limited cooling air (EN IEC 60664-1 ed.3: 2020)
Standards of conformity	EMC EN 61000-6-2 ed.4:2019, EN IEC 61000-6-4 ed.3:2019
	EN IEC 62368-1 ed. 2:2020+A11:2020
	EN IEC 63000:2019

Terminals

Terminals and connectors

DO1…DO4	relay output 1…4, normally open against C1…C4
C1…C4	relay output 1…4, ground
DO5, DO6	SSR outputs 5 and 6, normally open against C56
C5, C6	SSR output 5 a 6, ground (common)
DI1…4	digital inputs 1…4
G	power
G0	power
TE	optional connection for shielding
AI1…4	analogue input 1...4
AIC	**analogue input ground** (common)
	Notice:
	All analogue inputs AI1 to AI4 have common ground AIC. The inputs are optically separated from the other parts of the I/O module. For three-wire connection (active sensors, e.g. pressure, humidity), the analogue input ground AIC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the IMIO module.
AO1, AO2	analogue outputs 1 and 2
AOC	**analogue outputs ground** (common)
	Notice:
	The ground is optically separated from the other parts of the I/O module. For three-wire connection (active periphery, e.g. valves actuators, frequency changer), the analogue output ground AOC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the IMIO module.
RS485	port COM1 – serial line RS485, terminals K+, K-
Eth0, Eth1	network interface

LED indication

RUN	yellow LED – system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in other pattern, LED is permanently ON or OFF)
TxD	red LED – transmitting data at COM1 (flashing: receiving data; still ON: shortcircuited or overload bus)
PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, …)

DIP switches

STOP	if ON runtime is running, program execution is stopped
INIT	if ON at power-up, configuration parameters are brought to defaults (see Configuration parameters in Merbon IDE;

e.g. IP address, user and password, database settings, proxy, …)
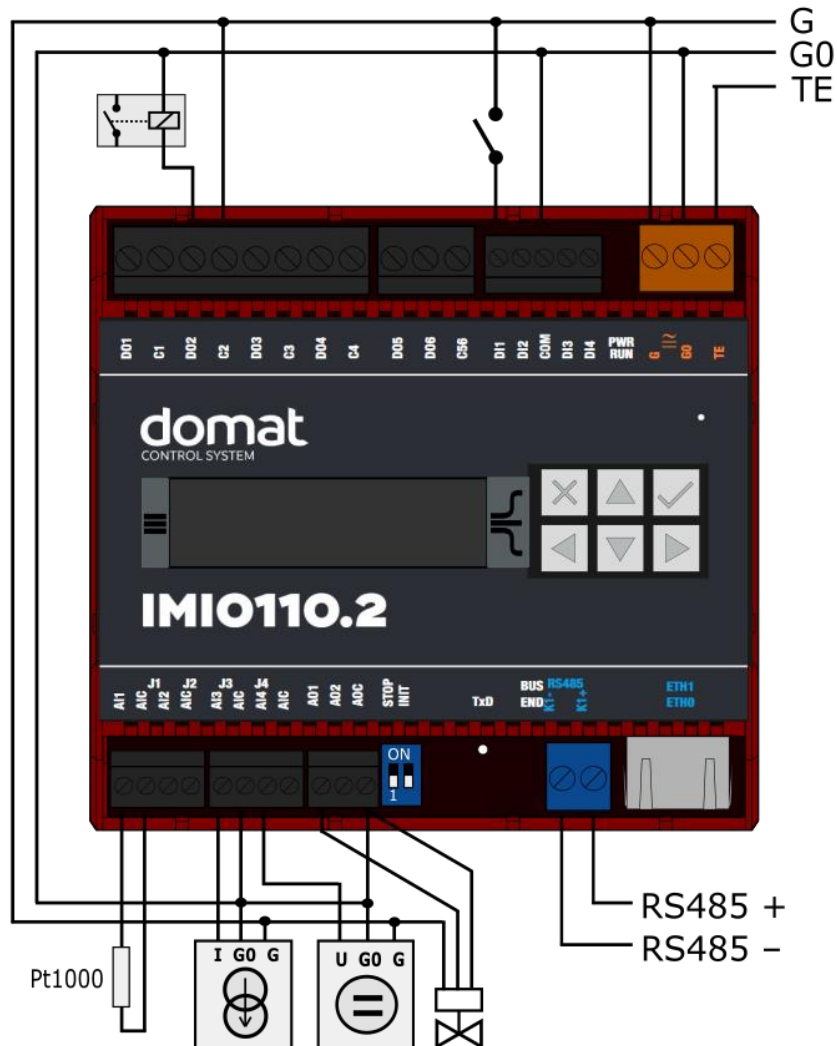
BUS END   DIP3 and DIP4 both ON = bus end RS485; the first and last devices on bus should have bus end ON
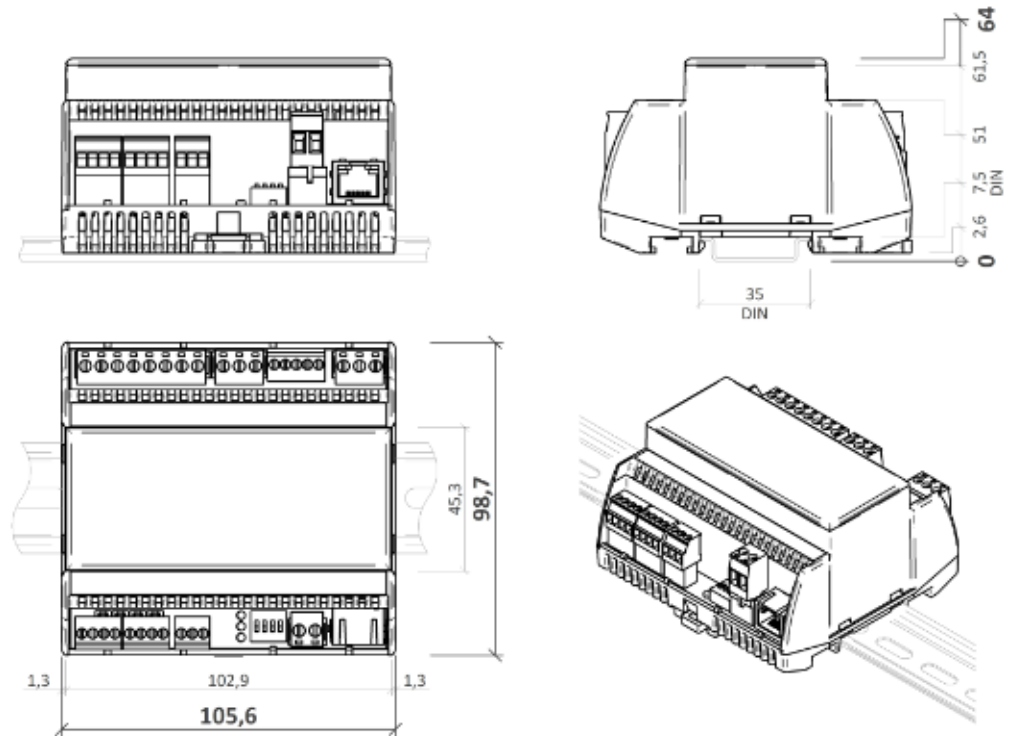
Jumpers   The jumpers are available after the AI terminals are removed. Default setting is resistance (passive temperature) measuring. Change the settings for voltage range (see table below). Take out the jumper and plug in an external resistor of 125 Ohm between terminals AI3-AIC or AI4-AIC for 0...20 mA range. **The setting is valid only for AI3 and AI4, other analogue inputs are for resistance only!** (Jumpers numbered from the left.)

	Resistance (temperature)	Voltage
AI3	J1=OFF, J2=ON	J1=ON, J2=OFF
AI4	J3=OFF, J4=ON	J3=ON, J4=OFF

Connection

Dimensions

Dimensions are in *mm*.

Programming   **Merbon IDE**

Programming tool Merbon IDE contains I/O editor, graphical editor of the function plan (FBD), structure text editor, web page editor and LCD menu editor (HMI) for PLC and compiler.

The application program consists of function blocks which are stored in libraries. Those contain analogue and digital functions, mathematical blocks including goniometric functions, time schedulers, alarm blocks, and HVAC specific blocks (heat recovery, dewpoint calculation, enthalpy, pump switch etc.). In addition to function blocks, the application program can also be compiled from structured text, or a combination of both languages can be used.

The minimum guaranteed number of records for history on the PLC is 79 000, but the actual number of stored samples may be larger depending on the data types that are stored in the history.

Communication   Default network settings are:

IP address:	192.168.1.10
subnet mask:	255.255.255.0
default gateway:	192.168.1.1

SSCP user: admin
Password: rw

Notice: Do not forget to record the new network settings after change!

After these values have been changed, it is possible to bring the process station into default settings by the INIT DIP switch: set INIT to ON and restart the station. All values in the PLC configuration are set to defaults. The PLC will respond at the default IP address and it is possible to change the old address through Merbon IDE.

The controllers can share variables over the Ethernet network (outside temperature, heat demands etc.) together with other PLC platforms.

The runtime provides drivers for communication with I/O modules and other subsystems which communicates e.g. through Modbus TCP/RTU (server/client), M-Bus, IEC62056-21, SSCP, SoftPLC link and BACnet IP server/client (see PICS). The complete list of drivers can be found in the Channel configuration dialogue in the most recent Merbon release. Please check the required protocol features and functions with the list of implemented features in the Merbon IDE help. It is also possible to program own communication drivers using the I/O library functions in structure text language.

Number of communication channels (on the serial lines and Ethernet) to I/O modules and subsystems is not directly restricted. It depends on available RAM PLC memory.

Number of connections from SSCP clients is max. 20. This includes connections from Merbon IDE, Merbon SCADA, HT104/200, mobile application Merbon Visual, connection from other PLCs over SSCP etc.

Uploading a project from the Merbon IDE reserves two SSCP TCP connections.

Number of connections from Modbus TCP clients on Modbus TCP server is max. 5.

In case of implementation of your own ST driver, there is limitation of max. 10 clients connected simultaneously.

Other clients channels (web etc.) are not directly restricted.

WEEE notice The device contains a non-rechargeable battery which backups the real-time clock and part of the memory. After the device is not operable, please return it to the manufacturer or dispose of it in compliance with local regulations.

Safety note The device is designed for monitoring and control of heating, ventilation, and air conditioning systems. It must not be used for protection of persons against health risks or death, as a safety element, or in applications where its failure could lead to physical or property damage or environmental damage. All risks related to device operation must be considered together with design, installation, and operation of the entire control system which the device is part of.

Changes in versions

03/2022 – First datasheet version.
04/2022 – Number of data points specified.

mark520   DDC controller

Summary

DDC (Direct digital control) controller mark520 is free programmable process station on i.MX6 UL processor and OS Linux. They are suitable for control of large installation (approximately 400…500 physical data points). Mark520 contains 2× Ethernet port, 2× RS485 interface, and 2× RS232 interface for connecting I/O modules. Compared to mark320LX process station the mark520 has bigger memory (512 MB RAM, 256 MB FLASH) and support for .NET drivers.

Application

- **Free programmable control units for HVAC systems and other applications with local HMI and web access**
- **Data acquisition, processing, and presentation systems with advanced networking features**
- **Controls of power systems, photovoltaic power plants etc.**
- **Protocol converters with web data presentation (must be programmed by user)**

Function

The controller hosts an embedded Linux operating system which boots up the Domat runtime with the application. The board contains real time clock with battery backup, flash memory containing OS, runtime, application, and other data (time programs, setpoints etc.), and a watchdog. It is also possible to use NVRAM to backup parameters in case of unexpected system shutdown.

The application is created and uploaded in the Domat IDE development environment. The maximum application program size depends on number of physical and software data points, amount of function blocks which require more memory (e.g. time schedulers), degree of code optimisation, and number of connections the PLC has to handle.

For communication with other devices, mark520 contains 2× Ethernet port, 2× a RS485 interface and 2× a RS232 interface.
The process station contains a web server for remote connection and user control. The web pages are created in Domat IDE through which is then web definition

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uploaded to the process station (see Web definition in PLC properties). Web is not recommended for safety reasons to use in free Internet. It is designed to operate on a local network. In the network topology design is therefore expected to be pre-configured router or any other element that provides network security.

The process station can be operated through a 3 × 16 characters backlit LCD display and 6 backlit pushbuttons. Users move in the menu using buttons – the **active row is the middle row**. Objects such as Value setting, Alarm, and Time schedule have predefined functionality, and thus for the configuration it is only necessary to set addresses, assign data points, and complete user texts.

The user menu structure is configured and uploaded to the process station through Domat IDE (see LCD menu definition in PLC properties).

The module is 105 mm wide and mounts on a standard DIN rail. MarkPLC kit for mounting into an aperture in panel door or any suitable box can be ordered.

Technical data		
	Power	24 V AC/DC ± 20 %; 6 W
	Communication	
	Ethernet	2 × Ethernet 10/100BaseT
		RJ45, 2 LED (link, data) integrated in the connector
	RS232	COM1, COM2
		2 × CANNON 9 male; pin 2=RX, 3=TX, 4=DSR, 5=GND, 6=DTR, 7=RTS, 8=CTS
		300...115 200 bit/s, parity and bits are set in SW
	RS485	COM3, COM4 RS485 (K+, K-)
		2 separated buses galvanically insulated from each other, insulating voltage 1 kV
		300...115 200 bit/s, parity and bits are set in SW
		maximal bus length 1200 m
		maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications use about 300...400 physical data points on the bus
	LCD display	3 rows × 16 characters, blue backlight
		manually adjustable backlight intensity
		possibility to switch off the backlight through application software
	Buttons	6 backlit buttons
	6× LED – mark520LX	RUN, PWR, 2× RS485 RxD/TxD
	HW	ARM i.MX6UL 528 MHz, 256 MB FLASH, 512 MB RAM, 128 kB NVRAM FRAM
	SW	Domat IDE+

Housing	polycarbonate box (certification UL94V0)
Dimensions	105.6 × 98.7 × 61.4 mm
Aperture dimensions	102 (width) × 45 (high) mm; tolerance +1 mm
Protection degree	IP20 (EN 60529+A1+A2)
Terminals	screw terminals M3, recommended wire diameter 0.35…1.5 mm²
Ambient temperature	from -20…50 °C; 5…85% relative humidity; non-condensing gases, chemically non-aggressive conditions, fog, ice and frost (according EN IEC 60721-3-3 ed. 2:2019 climatic class 3K22, 1K21, 3M11)
	for installation at high altitude, it is necessary to consider the reduction of dielectric strength and a limited cooling air (EN IEC 60664-1 ed.3: 2020)
Standards of conformity	EMC EN IEC 61000-6-2 ed. 4:2019, EN IEC 61000-6-4 ed. 3:2019 (industrial environment)
	electrical safety EN IEC 62368-1 ed. 2:2020+A11:2020
	hazardous substances reduction EN IEC 63000:2019
Accessories	markPLCkit – frame for mounting mark520 into an aperture in panel door or any suitable box
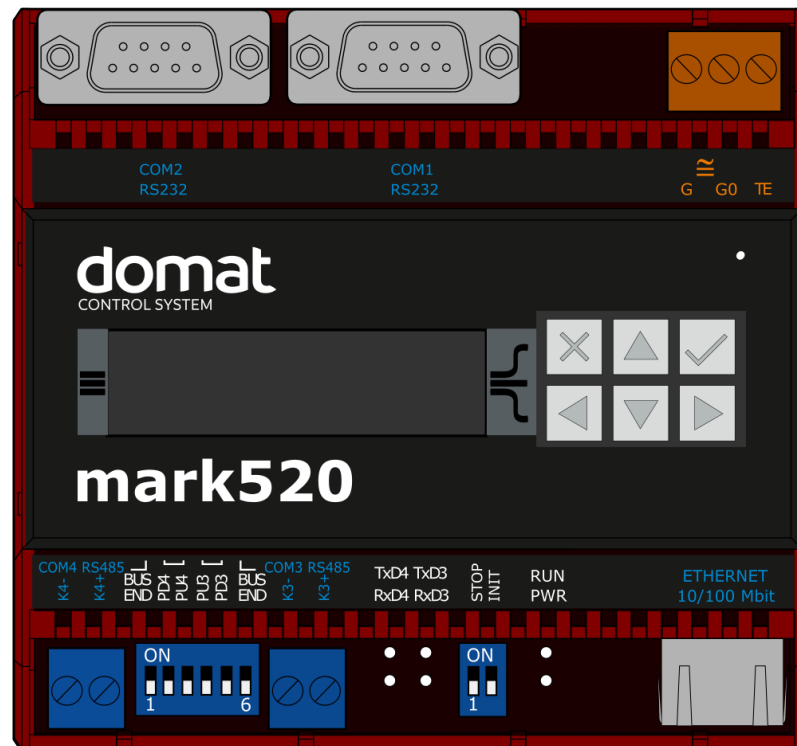
Terminals

Terminals and connectors

COM1	port COM1 - serial link RS232; CANNON 9 male
COM2	port COM2 - serial link RS232; CANNON 9 male
COM3	port COM3 - serial link RS485, terminals K+, K-
COM4	port COM4 - serial link RS485, terminals K+, K-
Ethernet	network interface

G	power
G0	power
TE	optional connection for shielding (on the back side in the DIN rail groove there is a metal strip which connects TE to DIN rail after the device is snapped on the rail)

LED indication

RUN	green LED – system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in other pattern, LED is still ON or OFF)
PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, …)
RxD3	green LED – RS485 receiving data at COM3 (flashing: receiving data; OFF: no data traffic)
TxD3	red LED – RS485 transmitting data at COM3 (flashing: transmitting data; OFF: no data traffic)
RxD4	green LED – RS485 receiving data at COM4 (flashing: receiving data; OFF: no data traffic)
TxD4	red LED – RS485 transmitting data at COM4 (flashing: transmitting data; OFF: no data traffic)

DIP switches

STOP	if ON runtime is running, program execution is stopped
INIT	if ON at power-up, configuration parameters are brought to defaults (see Configuration parameters in Domat IDE; for example IP address, user and password, database settings, proxy, …)
BUS END	(DIP6 next to COM3 RS485) bus end COM3; the first and last devices on bus should have bus end ON
BUS END	(DIP1 next to COM4 RS485) bus end COM4; the first and last devices on bus should have bus end ON
PU3	pull-up resistor for COM3
PD3	pull-down resistor for COM3
PU4	pull-up resistor for COM4
PD4	pull-down resistor for COM4

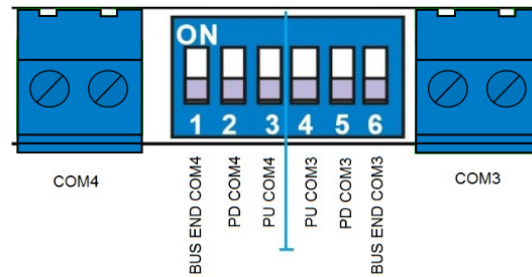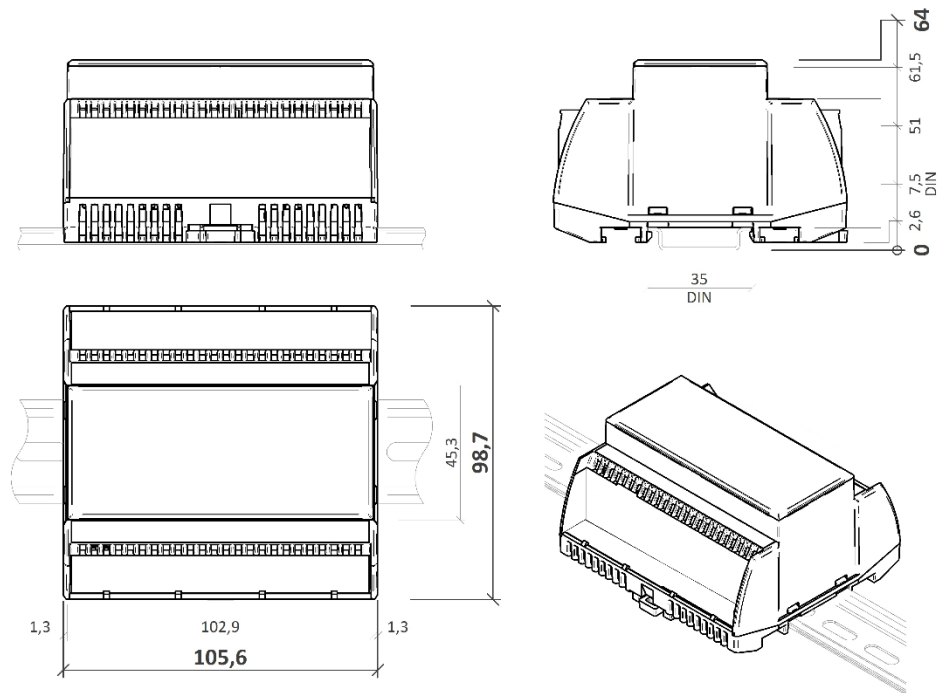|	
DIP BUS END, PU/PD	Bus End and pull up / pull down switches: Three switches on the left belong to COM4, three switches on the right belong to COM3. Unlike for the other modules and controllers, the bus is terminated (BUS END) with one switch only (SW1 and SW6). The inner switches (2 and 3 for COM4, 4 and 5 for COM3) are pull-up and pull-down switches for K+, and K- wires: The K- signal is bound over a resistor to RS485 ground (PD switch), the K+ links over a resistor to +5V power of the bus driver (PU switch).

Unlike at the older PLC versions, the RS485 buses are separated from each other. It is possible to activate all PU and PD switches at the same time.

Dimensions

Dimensions are in *mm*.

Programming   **Domat IDE**

Programming tool Domat IDE contains I/O editor, graphical editor of the function plan (FBD), structure text editor, web page editor and LCD menu editor (HMI) for PLC and compiler.

The application program consists of function blocks which are stored in libraries. Those contain analogue and digital functions, mathematical blocks including goniometric functions, time schedulers, alarm blocks, and HVAC specific blocks (heat recovery, dewpoint calculation, enthalpy, pump switch etc.). In addition to function blocks, the application program can also be compiled from structured text, or a combination of both languages can be used.

The minimum guaranteed number of records for history on the PLC is 37 000, but the actual number of stored samples may be larger depending on the data types that are stored in the history.

Communication   Default network settings are:

IP address	192.168.1.10
subnet mask	255.255.255.0
default gateway	192.168.1.1

SSCP user: admin
Password: rw

Notice: Do not forget to note the new network settings after change!

After these values have been changed, it is possible to bring the process station into default settings by the INIT DIP switch: set INIT to ON and restart the station. All values in the PLC configuration are set to defaults. The PLC will respond at the default IP address and it is possible to change the old address through Domat IDE.

The controllers can share variables over the Ethernet network (outside temperature, heat demands etc.) together with other PLC platforms.

The runtime provides drivers for communication with subsystems. For example Domat runtime contains: Modbus TCP / RTU (server/client), M-Bus, IEC62056-21, SSCP, and SoftPLC link. The complete list of drivers can be found in the Channel configuration dialogue in the most recent Domat release. Please check the required protocol features and functions with the list of implemented features in the Domat IDE help. It is also possible to program own communication drivers using the I/O library functions in structure text language.

Number of communication channels (on the serial lines and Ethernet) to I/O modules and subsystems is not directly restricted. It depends on available RAM PLC memory. **Number of connections from SSCP clients is max. 20.** This includes connections from Domat IDE, Domat SCADA, HT200, mobile application Domat Visual, connection from other PLCs over SSCP etc.

Number of connections from Modbus TCP clients on Modbus TCP server is max. 5. In case of implementation of your own ST driver, there is limitation of max. 10 clients connected simultaneously.

Uploading a project from the Domat IDE reserves two SSCP TCP connections.

Other clients channels (web, …) are not directly restricted.

WEEE notice   The device contains a non-rechargeable battery which backups the real-time clock and part of the memory. After the device is not operable, please return it to the manufacturer or dispose of it in compliance with local regulations.

Safety note   The device is designed for monitoring and control of heating, ventilation, and air conditioning systems. It must not be used for protection of persons against health risks or death, as a safety element, or in applications where its failure could lead to physical or property damage or environmental damage. All risks related to device operation must be considered together with design, installation, and operation of the entire control system which the device is part of.

Cyber security note
The product may influence the information and cyber security (ICS) of the control system. It is supplied in default settings. Implementation and continuous compliance with the ICS rules (e.g. creating and upload of certificates and keys, their updates and management, protection against misuse, etc.) are fully the responsibility of the control system operator. The manufacturer is not responsible for damages which originated or may originate due of wrong or insufficient implementation of ICS rules when using the device. In case of questions, please contact Domat Control System technical support.

Changes in versions   12/2023 – First version of datasheet.
04/2024 – Addition of pin descriptions for CAN 9 (RS-232) ports.